THE AMERICAN ORB-WEAVER GENERA *DOLICHOGNATHA* AND *TETRAGNATHA* NORTH OF MEXICO (ARANEAE: ARANEIDAE, TETRAGNATHINAE)

HERBERT W. LEVI[1]

ABSTRACT. One species of *Dolichognatha* and fifteen species of *Tetragnatha* are found in North America north of Mexico. Of these, three are new: *T. earnra* from the Everglades; *T. shoshone*, widespread in south central Canadian provinces and north central states; and *T. branda*, found from Connecticut to Mississippi.

Tetragnatha harrodi is a synonym of *T. dearmata*, described from northern Eurasia. *Tetragnatha antillana* is a synonym of the cosmotropical *T. nitens*.

Males of *Tetragnatha* are readily separated by the shape and structure of the palpal conductor and paracymbium; they cannot be separated by the structure of the chelicerae. Females can be separated by the configuration and placement of seminal receptacles, as revealed by simple dissection; they cannot be separated by the structure of the chelicerae.

Several *Tetragnatha* species are distributed from Canada to the tropics. Several uncommon species probably have specialized habitats: *T. viridis* in pines; *T. vermiformis* on reeds; and *T. branda* in salt marsh grass.

INTRODUCTION

One of the aims of a generic revision is to find diagnostic characters that separate the species. Reliable identification is essential for any work by ecologists and physiologists. Another aim, of course, is to reveal the relationships among the species, and, more important, the relationship of the genus to other genera.

Tetragnatha species are among the most abundant spiders worldwide. North American species can be determined only with difficulty using Chickering's papers (1957a, b, c, 1959). Chickering (with one exception) determined species correctly, but could determine only males; his drawings are awkward, often failing to tell what position is illustrated or whether the structure illustrated is from the left or right palpus. Also, his *Tetragnatha* reports are limited geographically to Michigan and to some tropical American regions. *Tetragnatha* is the second largest araneid genus north of Mexico, after *Araneus*.

Despite a conscious effort not to change names, two synonymies had to be resolved. To avoid further name changes, neotypes were designated for several old names, the use of which has been based mainly on tradition rather than on the type method. The neotypes were designated in accordance with Article 75 (1961) of the International Code of Zoological Nomenclature.

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[1] Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts 02138.

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The American Museum of Natural History provided about 4000 vials of common *Tetragnatha* species; the Museum of Comparative Zoology between 2000 and 2500 vials; the Canadian National Collections 600 vials; the Florida State Collection of Arthropods and the Exline-Peck collection about 300 vials each.

Mapping, rewriting, and typing were done by Cecile Villars; some rewriting was done by L. R. Levi. John Hunter and Edward Seling made the scanning electron micrographs.

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METHODS OF STUDY

1. *Background.* Washed sand is the ideal surface on which to examine the long-legged *Tetragnatha* in various views. The palpus does not usually have to be removed to reveal its diagnostic features; however, magnification of at least 50 to 80 times is required to examine the shape of the tip of the conductor.

2. *Seminal Receptacles.* To determine females it is necessary to examine the seminal receptacles. At first this was done by removing the genital area and clearing it in clove oil or mounting it on a slide: the cleared genital area has been illustrated for all species. Because of their large size, it is more difficult and time-consuming to clear the whole spider.

An easier method is to lift the exoskeleton of the genital operculum, carefully separating it from clinging tissues, and search for the lightly sclerotized seminal receptacles. Most species can readily be determined by the position and shape of the seminal receptacles (together with eye placement).

To lift the genital cover, cut with a mounted and sharpened minutenadel, starting from the anterior corner between the book-lung spiracle and the genital cover, cutting in a posterior direction toward the genital opening. After cutting, carefully lift the exoskeleton and remove tissue clinging to it. Fold the cover back and probe for the seminal receptacles in the tissues adjacent to the cut. Some practice is necessary. Many *Tetragnatha* species are sufficiently common so that a few specimens can be sacrificed for the purpose. While penultimate female specimens may have an indistinct genital cover, the seminal receptacles are not present.

The final method used was to peel the genital cover to the side, place the whole spider in clove oil, and watch the genital area clearing: the area between the seminal receptacles clears first; later the tissue around the more dorsal median receptacle. (The spider should then be removed and the oil washed out in alcohol.)

3. *Eye Distance.* The distance between anterior and posterior lateral eyes is variable. Nevertheless, the relative distance between the two lateral and the two median eyes is consistent and useful. It is best seen from the side with the specimen lodged in sand. The distances were measured from the center of the eye.

4. *Chelicerae.* I first tried to study the genus by illustrating the chelicerae of males and females of various species. But I could not consistently separate species using the shape and number of cheliceral teeth in the fang groove, the shape of the fang, presence of fang cusps (a hump at point of greatest curvature), or length of the chelicerae. Such characters vary enormously within species (Figs. 83–87). Chickering also found the chelicerae unreliable, and depended on palpi to separate the males. Only one mistake was

found in his many determinations of males: he labeled the rare *T. viridis* as *T. versicolor* in collections. However, Chickering resorted to characters of the chelicerae to determine females, and many of these determinations were wrong. The teeth and chelicerae are useful nevertheless in limited ways: male *T. dearmata* and *T. pallescens* always lack the first, distal, long tooth; *T. elongata* generally has longer chelicerae than *T. versicolor*.

Some authors have determined immature North American specimens on the basis of the cheliceral teeth, burdening students of the genus with much questionable reporting. To elevate chelicerae to a reliable character, it would be necessary to raise the inhabitants of egg-sacs of different species and study the allometric growth and development of their chelicerae and teeth. *Tetragnatha* species, like other Araneidae and many other spiders, mature after a variable number of molts; some mature specimens are twice the size of others. In addition, perhaps due to hormonal influences, the chelicerae of some individuals are more developed than those of others (e.g., *T. elongata*, Fig. 83 and *T. pallescens* from Florida, Figs. 134, 135). Other species have larger chelicerae in southern localities than in northern ones (e.g., *T. elongata*, Figs. 84–87). I judged the previous determinations of immatures doubtful because the identifiers often could not place adult specimens correctly.

5. *Measurements.* Measurements of total length are from the clypeus to the posterior tip of the abdomen. Initially ten to twenty specimens of each species were measured to establish variation; subsequently only extremely large and small individuals were measured. If there was a geographical difference in size, this was noted. Total length is not a good measurement, as it is difficult to repeat, and the measurements are intended only to give a general idea of size range, not as a statistical tool to distinguish between species. Furthermore, the smallest size of mature females is only an estimate; dissection was not always made to demonstrate maturity.

6. *Determination.* In this study, for which perhaps 30,000 to 40,000 specimens were available, I had to take some shortcuts to get data for the revision. I did not determine the contents of all vials, nor could I sort some mixed collections. Usually only a male was selected from the vial and carefully examined and recorded. In collections that consisted only of females, I did not examine a specimen unless it was from a poorly collected area or a less common species was suspected. It is possible to determine adult females, but it is less time-consuming to determine males. Gathering data for this revision had a higher priority than labeling collections.

7. *Dubious Species.* In the past when there was doubt as to the distinctness of species (or genera), I tended to lump them, considering it more parsimonious to lump than to split. However, I am aware that some mistakes have been made. *Araniella* (Levi, 1974) of Europe, for instance, contains a number of species, all with similar genitalia but different habits. Unfortunately, I had examined only a few specimens and failed to consult colleagues who knew the species in the field. Also, the genus *Latrodectus* in the family Theridiidae (Levi, 1959) is now known to contain many species difficult to identify by genitalia. Renewed studies are needed for both.

Similarly, what is considered *Tetragnatha versicolor* here may turn out to be several related species. It is particularly disconcerting that the genitalia of *T. viridis*, certainly a distinct species, are very similar to the genitalia of southeastern *T. versicolor*; *T. viridis* differs by being green or reddish in coloration, in having the lateral eyes as far apart as the medians, and in having unusually long mac-

rosetae on the legs. While the genitalia of *T. viridis* strikingly resemble those of southeastern *T. versicolor*, there is greater genitalic difference between southeastern and western *T. versicolor* (Figs. 104–109), suggesting that there may be other sibling species.

8. *Variation. Tetragnatha* species vary as widely in size as do other Araneidae, some individuals being almost twice as large as others of the same species. Is the variability in size a preadaptation to dwarf males found in various genera of the family? Large and small individuals of the same species have different dentition on the chelicerae; smaller individuals have fewer teeth, and the teeth may be relatively larger than those of larger-sized individuals (Figs. 83–87).

9. *Illustrations.* The conventions of illustrations were followed. The light comes from the upper left. In dorsal view, anterior is placed on top; in side view, anterior is on the left. These conventions were not followed for palpi; they are considered separate structures for ease of visualization.

10. *Scanning Electron Micrographs.* Scanning electron micrographs (SEM) were made of conductors and their tips after the illustrations had been completed. It was hoped the SEM would add details for the diagnostic features. While the photographs added these details (Plates 5–7), drying the palpi prior to SEM twisted the soft pleats of tissue and gave the structures a greater curvature; some tips were turned. The drawings were only touched up after examining the photographs; they were not changed. It appears that scanning electron micrographs alone are not a substitute for illustrations made under a dissecting microscope, but are a valuable additional tool.

PHYLOGENETIC CONSIDERATIONS

1. *Tetragnatha.* Tetragnathids are not primitive spiders, various contrary published opinions notwithstanding. The following characters, some shared with species of other genera, are evidence of specialization: the palpus has a separate paracymbium (also in *Pachygnatha* and Linyphiidae); there is no tapetum in the secondary eyes (*Dolichognatha* and *Azilia* share this feature; *Pachygnatha* lacks tapetum only in the posterior median eyes); the lateral eyes are often separated (also in *Azilia*); the chelicerae are modified as holdfasts for mating (also in *Pachygnatha*, *Dolichognatha*, and perhaps other genera); the endites are elongate and widened distally (also in *Pachygnatha*); and when resting, the femoral-patellar joint is straight (Plates 3, 4) (also in most relatives and in Metinae, but not in *Dolichognatha* [Plate 1]).

Primitive features include: the relatively long-lived males; the lack of an embolus cap on the male palpus, allowing males to mate several times; and, perhaps, the use of both palpi simultaneously in sperm induction.

The female genitalia are referred to repeatedly in the literature as haplogyne and primitive. The absence of an epigynum (separate copulating pore) is almost certainly adaptive and specialized. The strong coupling of male and female chelicerae when mating obviates the need for another coupling guide. When mating, the male's venter faces that of the female, and the female's genital opening is directly underneath the male's palpus. The female can curl her abdomen to facilitate the insertion of the embolus (Plate 4).

The median "seminal receptacle" of the female genitalia is almost certainly not that. Wiehle (1967) could not find sperm in this structure, nor does the shape of this structure suggest a sperm storage function. I think it was Stefan Heimer (in correspondence) who suggested that it might be a holdfast for the tip of the conductor. Evidence for this is seen in the shape of the conductor. In those species in which the conductor tip is a large hook, there is little or no me-

dian structure (*viridis, laboriosa, pallescens, caudata, vermiformis*). Species in which the conductor tip is a knob have a spherical median structure (*guatemalensis, elongata, straminea, vermiformis, nitens*). In one species the conductor tip is filiform; here the structure is elongate, apparently matching the filiform tip (*dearmata*, Fig. 83). Perhaps the primitive, haplogyne median seminal receptacle is homologous and was a preadaptation for this structure. To verify these ideas it will be necessary to preserve mating individuals and examine the inserted palpi.

2. *Glenognatha* and *Pachygnatha*. The presence (or absence) of an elaborate tracheal system is of minor phylogenetic importance, and may reflect small size and large surface, or may be an adaptation against water loss in a more arid environment. With a more elaborate and functional tracheal system, the posterior tracheal spiracle moves to an anterior position in *Glenognatha* (as well as in other groups, e.g., some *Dipoena* species and Anyphaenidae). Tracheae are well known to be plastic and adaptive characters, and developed as a result of need (Levi, 1967). The distribution of tracheae is part of a built-in pattern of body growth. Although this general pattern of growth is fixed, variation in detail can be influenced by local need. For instance, by implanting glands that have a high oxygen requirement, it has been demonstrated in insects that the demand for oxygen stimulates an exaggerated production and outgrowth of new tracheae and tracheoles which invest and penetrate the implanted organ. The growing tracheal cells seem to be attracted by sites of reduced oxygen tension (Wigglesworth, 1972).

The palpal structures and female genital structures of *Glenognatha* and *Pachygnatha* share several derived characters, synapomorphies, (Levi, 1980a). Most important, in both, as in *Tetragnatha*, the median rhabdom loops fill the posterior median eyes and the canoe-shaped tapetum has been lost. The canoe-shaped tapetum is still present in the lateral eyes of both *Glenognatha* and *Pachygnatha*, but has been lost in the lateral eyes of *Tetragnatha, Dolichognatha*, and *Azilia*.

3. *Uloborids*. Uloborids share a number of characters with *Tetragnatha*: separation of the lateral eyes; loss of tapetum in secondary eyes; presence of trichobothria proximally on the femora; frequent absence of an epigynum (Opell, 1979); and similarities of palpal structure. Most important perhaps is that many uloborids make an orb-web, as do tetragnathids and all Araneidae. Are these shared characters synapomorphies?

The separate lateral eyes may be a synapomorphy; more likely not. This feature is no doubt related to the resting position of the spiders: unlike most Araneidae, *Tetragnatha* (and uloborids) extend the legs when resting (Plates 3, 4) rather than pulling the anterior legs back so the femoral-patellar joint is flexed. With the anterior legs flexed, there is little space to permit lateral vision (Plate 1). In most Araneoidea the lateral eyes touch; their separation in *Tetragnatha* is no doubt a specialization.

Loss of the tapetum, like loss of any structure, is a poor character for combining groups. The loss in *Tetragnatha* indicates a specialization from the *Araneus*-like eye: the loops of rhabdoms to the median side of the canoe-shaped tapetum fill the back of the eye (Figs. 21, 22) and the tapetum is lost. There is no indication, as there is in *Tetragnatha*, that the ancestor of *Uloborus* had a canoe-shaped tapetum. Perhaps rhabdom rows got scrambled and rows will still be found in some members of the family.

The trichobothria on the femora (Fig. 17) may be a second synapomorphy. But perhaps these trichobothria have a specific sensory function, evolved in response to a similar need in uloborids and *Tetragnatha*. I do not know how common femoral trichobothria are in other

spiders, but they are certainly absent in most Araneidae and probably in most Araneoidea.

The absence of the epigynum among *Tetragnatha* is probably related to the coupling of chelicerae when mating. There is no such correspondence in uloborids. Again, loss of a structure is a poor character to relate groups.

The complex orb construction behavior can perhaps be considered a synapomorphy. Several striking points set uloborids apart from Araneoidea, including tetragnathids, and make a close association unlikely: 1) the cribellum, generally considered a primitive structure, has been lost a number of times in spiders that gave up webs in favor of hunting, but it is present in uloborids, as is a calamistrum; 2) the loss of poison glands in the chelicerae (also reported in the unrelated liphistiomorph *Heptathela*) is a very unusual specialization, possible only in spiders that overpower their prey by wrapping in silk; 3) the rhabdom arrangement within the eye is not like that found in Araneoidea (Homann, 1950, 1971); and 4) the important structure of the male palpi is not close to that of Araneoidea generally, although closest to that of *Tetragnatha*. Other unique attributes of uloborids are the hair covering, the individual hairs often being constricted at the base; the elongate labium; and the laterally bulging sternum.

Tetragnatha is close to *Meta*, and spiders related to *Meta* are probably the most primitive Araneoidea, having most plesiomorph characters of the superfamily. The orb-web is present in *Meta* but has been lost in some specialized Araneidae (*Archemorus*, *Mastophora*) and Uloboridae (*Miagrammopes*). The orb-web must be a primitive structure, and the webs of theridiids and linyphiids derived (see also Brignoli, 1979; Levi, 1980b).

Growth and Size. All spider individuals pass through a succession of molts before maturing; the number of molts varies even within a given species. Individuals that undergo fewer molts are smaller in mature size than those that matured after a greater number of molts. The size range is greater among adults of araneid species than in species of other families. Usually in any araneid population some mature individuals are twice the size of others, and there may be large geographical size variation as well. Perhaps such size variations preadapt for the occurrence of dwarf males in various araneid genera. The variability in number of instars of spiders differs from the steady number in most mites and pseudoscorpions.

If individuals mature at various sizes, are the small and large adults proportional or are the adults the result of allometric growth? This knowledge is important not only for those who want to use random numerical methods to differentiate species, but also for those who want to differentiate *Tetragnatha* species by proportions and cheliceral teeth.

Illustrations and measurements were made of a large male *T. elongata* from Texas (Fig. 87), and a small male from Wisconsin (Fig. 85). The total length of the large male was 8.6 mm; the small one, 6.2 mm (72% the total length of the large one). The length of the smaller carapace, as measured on the illustration, was 72% of that of the larger one. The smaller chelicerae measured 60% of the cheliceral length of the larger spider. The length of the palpal tibia-tarsus was 60%, but the smaller palpal bulb was 80% of the larger one, and the length of the conductor was 88%. The seminal receptacles of a large Texas female are slightly smaller than those of a smaller female from Massachusetts. But more important is that the chelicerae and their teeth, commonly used to differentiate *Tetragnatha* species, differ widely. (The left chelicera pictured in Figure 85 had two teeth next to each other, but this condition was not present on the right chelicera of the same individual.) While the large individuals of *T. elongata* had many more cheliceral teeth

than did the small individuals, the most characteristic teeth as well as the spur were present in both sizes. Of great interest are relative changes in proportions of the palpal cymbium. Does the cymbium correspond more with leg length than with that of the palpal bulb? The cymbium of the large Texas specimen extends beyond the tip of the conductor (Fig. 87); that of the small Wisconsin individual is shorter than the conductor (Fig. 85).

To summarize, growth is allometric, and the genitalia of larger and smaller individuals are more alike than other body parts. Random measurements might generally separate size classes and are not so useful as the study of genitalia for the separation of species. Also, the chelicerae are not as diagnostic as the genitalia. Seeley's study (1928), which revised North American *Tetragnatha* using mainly the armature of the chelicerae, is only of limited use. Chickering's publication on the *Tetragnatha* of Michigan (1959), and those of Mexico, Central America, and Jamaica (1957a,b,c and 1962), used mainly the palpi and are still very usable although limited by awkward illustrations.

Plate 1. Unnamed *Dolichognatha* sp. from New Guinea hanging on debris; spider facing left.

Dolichognatha O. P.-Cambridge

Dolichognatha O. P.-Cambridge, 1869, Jour. Linnean Soc. London, 10: 387. Type species by monotypy *D. nietneri* O. P.-Cambridge, 1869, *ibid.*, p. 388, pl. 12, figs. 39–45, ♂, from Ceylon. Male holotype in the British Museum, Natural History, examined.

Landana Simon, 1883, Ann. Mus. Genova, 20: 184, erroneously placed in Archaeidae. Type species by monotypy *L. petiti* Simon, 1883, *ibid.*, p. 185, figs. 1–5, ♂, from the Congo. Male holotype in the Muséum National d'Histoire Naturelle, Paris, examined. NEW SYNONYMY.

Paraebius Thorell, 1894, Bihang Kongl. Svenska Vet.-Akad. Handl., 20: 43. Type species by monotypy *Paraebius mandibularis* Thorell, 1894, *ibid.*, p. 44. Male holotype from Sumatra in the Natural History Museum, Stockholm, examined. NEW SYNONYMY.

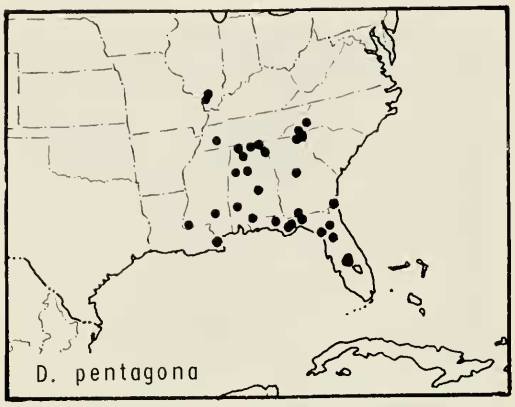
Prolochus Thorell, 1895, Descriptive catalog of the spiders of Burma, London, p. 122. Type species by monotypy *Prolochus longiceps* Thorell, 1895, *ibid.* Male holotype in the Natural History Museum, Stockholm, examined. NEW SYNONYMY.

Nicholasia Bryant and Archer, 1940, Psyche, 47: 60. Type species by monotypy *Epeira pentagona* Hentz, 1850. NEW SYNONYMY.

Afiamalu Marples, 1955, Jour. Linnean Soc. London, Zoology, 42: 495. Erroneously placed in Archaeidae. Type species by monotypy *Afiamalu richardi* Marples, 1955, *ibid.*, figs. 5, 7, 10, ♀, ♂, from western Samoa. NEW SYNONYMY.

Synonymies. Landana contains those species of *Dolichognatha* in which the males have longer chelicerae than females, and have the distal end of their chelicerae modified. As there are intermediates, it appears advisable to synonymize *Landana* with *Dolichognatha*. The *Paraebius* synonymy is uncertain. The male type examined lacked the characteristic four posterior abdominal humps. The cheliceral teeth were not all distal but spread out. The palpus is like that of *Dolichognatha*.

Prolochus belongs here, judging by the structure of the chelicerae, the palpus, and the poorly preserved abdomen. *Prolochus longiceps* differs in lacking pos-



Map 1. Distribution of *Dolichognatha pentagona* (Hentz).

terior median eyes, but in some species of *Dolichognatha* the posterior median eyes are reduced in size. *Nicholasia* was erected by Bryant and Archer (1940: 60) for *D. heptagona*, which "differs from the Ceylonese genotype in the form of web, as well as in several important structural characters." Bryant and Archer repeated E. Simon's report (1894: 743) that *Dolichognatha* makes a horizontal sheet web. This is Simon's error. According to Bryant and Archer, *Nicholasia* differs from *Dolichognatha* by the "truncate tip of the labium, fewer teeth on the interior margin of the mandible and by the male palpus which has a dorsal apophysis on the basal third of the cymbium and a much simpler palpus." *Afiamalu* resembles *Landana* in "the shape of the carapace and in having spines on the legs, but differs in the armature of the chelicerae and the presence of a serrula [on the endites]."

Diagnosis. Dolichognatha, like other tetragnathids, lacks a tapetum in the secondary eyes, and the rhabdoms are arranged in looping rows (Figs. 7, 8). It differs from both *Tetragnatha* and *Azilia* in the shape of the abdomen: higher than long, with two pairs of posterodorsal humps (Plate 1; Figs. 1, 2, 10); it differs from *Tetragnatha* in lacking trichobothria on the femora. Like *Azilia*, but unlike *Tetragnatha* and *Pachygnatha, Dolichognatha* has a simple epigynum in the female (Fig. 6), and the male palpi do not have the cymbium modified (Fig. 13). Unlike *Azilia, Dolichognatha* exhibits a palpal paracymbium which is a complicated sclerite, different in different species (Fig. 13); it is not a free sclerite as in *Tetragnatha. Dolichognatha*'s most distinctive character is the shape and coloration of the carapace: head, often dark, with parallel sides, and carapace evenly rounded, always light-colored. The short-fanged chelicerae (Figs. 1–3, 10, 11) may be so long as to resemble those of Archaeidae, and if they are greatly elongated, the head may lose the characteristic parallel sides. The posterior median eyes touch (Figs. 2, 3, 11), or are only slightly separated. They may be minute in size or, among species previously placed in *Prolochus,* are lost completely.

Description. Carapace: head brown with darker marks; thorax yellow-white. Chelicerae usually brown. Sternum yellow-white with dark marks. Coxae yellow-white with dark spots. Legs contrastingly banded, dark bands narrow. Dorsum of abdomen with white and black pigments; abdominal humps are light-colored posteriorly, dark-colored anteriorly (Figs. 1, 2). Sides of abdomen dark posteriorly. Ventrally, area between genital groove and spinnerets with paired white patches and black pigment. Sides and head parallel if chelicerae small. Thoracic depression barely visible. Lateral eyes separated from each other by about their diameter (Figs. 1, 8, 10). Height of

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Plate 2. Webs of *Dolichognatha pentagona*. Upper photograph, line of debris to the left of web's center (arrow), out of focus; web 12 cm diameter. Bottom photograph, with line of debris behind upper right outer spirals (arrow); web 7.5 cm diameter. Webs dusted with corn starch.

clypeus equal to diameter of the anterior median eyes. Anterior median eyes usually the largest (Figs. 3, 11). All lack tapetum, and secondary eyes have rhabdoms in rows as in *Tetragnatha* (Figs. 7, 8). Legs with strong macrosetae and sometimes denticles. Abdomen always higher than long and with four humps (Figs. 1, 2, 10). Femora without trichobothria, tibiae with a row or two, and metatarsi with one trichobothrium dorsally on the proximal end.

Epigynum lightly sclerotized and transverse (Fig. 6). Palpus simple, lightly sclerotized, except for the embolus (Figs. 13–15). Cymbium entire, with large attached paracymbium (P in Fig. 13).

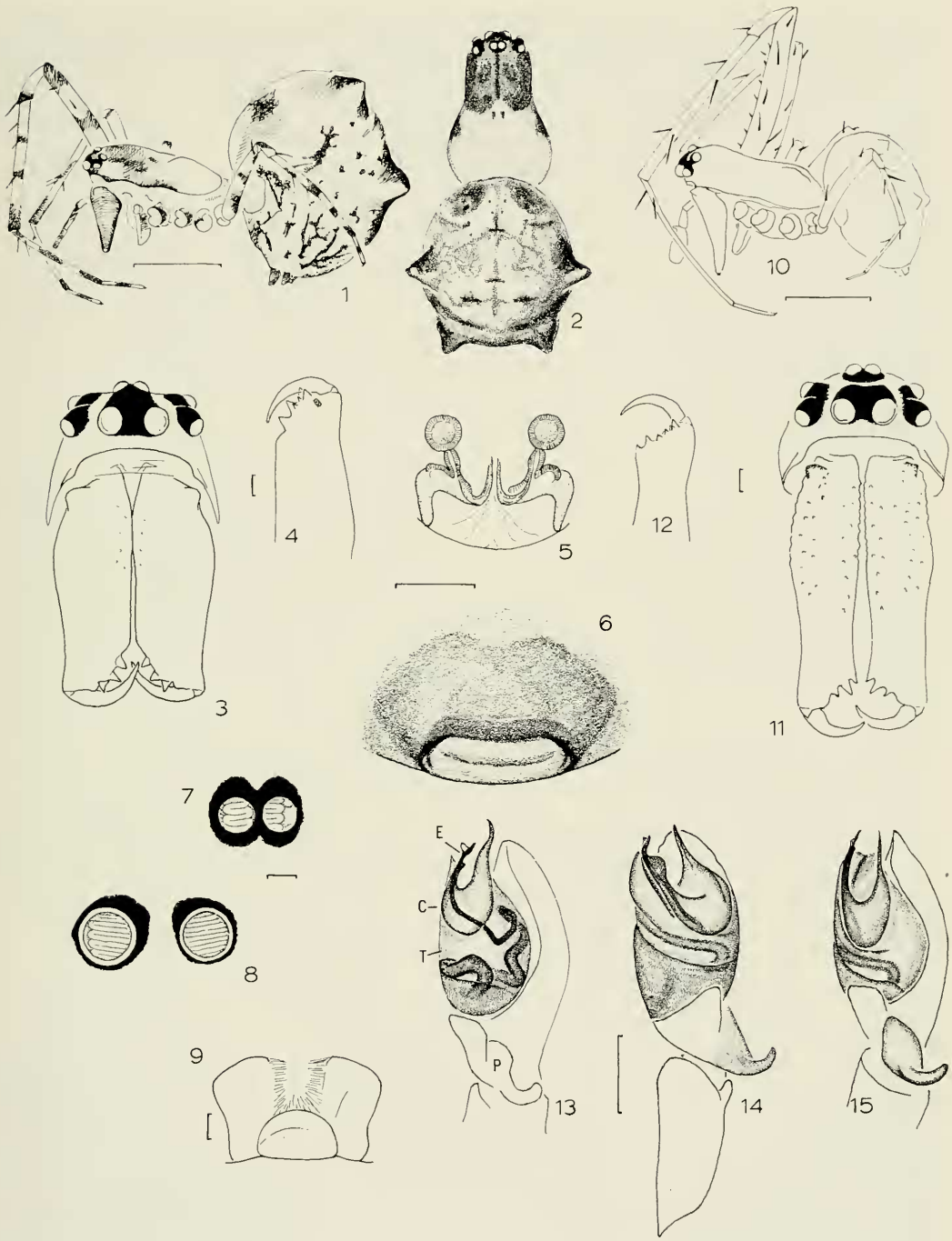
Natural History. I have seen the webs and habitats of four species of *Dolichognatha*: *D. pentagona* in the southeastern United States, two species in northern South America and one species in New Guinea. All constructed diagonal orb-webs between the buttress roots at the bases of large trees in relatively moist, dark forests. The web has a line of debris and egg-sacs across it or hanging vertically behind it (arrows, Plate 2). The spider rests among the debris. It is not surprising that collectors have at times marked specimens as an unknown species of *Cyclosa*. But the species is easily overlooked by collectors due to the specialized habitat, and individuals are not collected by sweeping. The web, often messy, does not stand out from other debris at the base of the tree, and the spider may not be on the web. Unlike other tetragnathids, *Dolichognatha* pulls the legs in at rest (Plate 1).

Species. Species of *Dolichognatha* are common worldwide in warm or tropical climates. The type species comes from Ceylon; there are specimens of different species from Africa in the Museum of Comparative Zoology collections. The genus is found in southeast Asia, and I have collected a species in New Guinea (Plate 1). Species differ only slightly in the shape of the abdomen and epigynum; there are greater differences in length and structure of chelicerae, in the internal female reproductive ducts, and in the structure of the paracymbium of the male palpus. Males of species with greatly elongated chelicerae also may have the cephalic carapace of diverse shapes and not have sides parallel as in *D. pentagona*. Males of some species have the fang groove at the distal end of the chelicerae modified and expanded. *Meta quadrituberculata* Keyserling, 1883, from Peru, belongs to the genus, as does *Cyclosa minuscula* Mello-Leitão.

Note. This genus does not belong to the family Archaeidae and is not related to *Archaea*, despite certain superficial resemblances. *Archaea*, unlike *Dolichognatha*, has scale-like body hair covering; has a more or less long, constricted neck between head and thorax; and has reduced lateral eyes. The endites of *Archaea* curve around the labium, and there is an elongate sternum. The unique spinnerets are the most important difference, and one that excludes the Archaeidae from the Araneoidea; the median spinnerets are minute, and the posterior spinnerets are much smaller than the anterior ones. *Zearchea* has only two spinnerets. The anal tubercle of *Archaea* is relatively large. The legs are thin and spindly, and there are only one or two trichobothria on the tibiae, one distally (unlike Araneoidea) on the metatarsus, none on the tarsus. The reduction of the spinnerets suggests association with the Zodarioidea; the loss of spinnerets is otherwise rare in Labidognatha.

Forster (1955) has illustrated an epigynum and a pair of seminal receptacles of archaeid spiders. His illustrations of archaeid palpi show few sclerites and much diversity among related species; the paracymbium is always absent. The sclerites are difficult to homologize with those of Araneoidea.

A key and illustrations to the Archaeidae of Madagascar can be found in Legendre (1970); a key to the genera was



Figures 1–15. *Dolichognatha pentagona* (Hentz). 1–9. Female. 1. Lateral. 2. Carapace and abdomen. 3. Eye region and chelicerae. 4. Left chelicera, posterior. 5. Epigynum, cleared, dorsal. 6. Epigynum. 7. Posterior median eyes. 8. Lateral eyes. 9. Labium and endites. 10–15. Male. 10. Left lateral. 11. Eye region and chelicerae. 12. Left chelicera, posterior. 13–15. Left palpus. 13. Lateral, expanded. 14. Ventral. 15. Lateral.

Scale lines. 0.1 mm; except Figs. 1, 2, 10, 1.0 mm.

Abbreviations. C, conductor; E, embolus; P, paracymbium; T, tegulum.

published by Forster (1955); and a list with distributions of all known species is in Legendre (1977).

Dolichognatha pentagona (Hentz), new combination

Plates 1, 2; Figures 1–15; Map 1

Epeira ? pentagona Hentz, 1850, J. Boston Soc. Natur. Hist., 6: 18, pl. 3, fig. 1, ♀. Specimens from Alabama, destroyed.

Cyrtophora tuberculata:—McCook, 1893, American Spiders, 3: 236, pl. 17, fig. 11, ♀. Probably not *D. tuberculata* Keyserling.

Dolichognatha tuberculata:—F. P.-Cambridge, 1903, Biologia Centrali-Americana, Araneidea, 2: 447. Probably not *D. tuberculata* Keyserling.

Nicholasia pentagona:—Bryant and Archer, 1940, Psyche, 47: 61, fig. 1, ♀, ♂. Archer, 1940, Paper Alabama Mus. Natur. Hist., 14: 27, pl. 2, fig. 1, web, pl. 5, figs. 1, 2, ♀, ♂.

Description. Female. Posterior median eyes 0.5 diameters of anterior medians; anterior laterals 0.8; posterior laterals 0.7 diameters of anterior medians. Posterior median eyes touching, 2.5 to 3 diameters from laterals (Figs. 1–3). The chelicerae are elongate with an anterior boss and a posterior hump (Figs. 1, 3, 10). There are three teeth on the anterior margin, two small ones on the posterior margins, and a longer one at the base of the fang (Fig. 4). Total length, 3.6 mm. Carapace, 1.7 mm long, 1.2 mm wide. First femur, 2.0 mm; patella and tibia, 2.4 mm; metatarsus, 1.6 mm; tarsus, 0.7 mm. Second patella and tibia, 1.9 mm; third, 1.0 mm; fourth, 1.2 mm.

Male, from Georgia. Eye arrangement as in female. Chelicerae much longer than those of female (Fig. 11). The palpus is rather small (Figs. 10, 14, 15). Total length, 3.2 mm. Carapace, 1.7 mm long, 1.1 mm wide. First femur, 2.2 mm; patella and tibia, 2.4 mm; metatarsus, 1.7 mm; tarsus, 0.7 mm. Second patella and tibia, 1.9 mm; third, 0.9 mm; fourth, 1.2 mm.

Variation. Total length of females, 2.6 to 4.0 mm; carapace, 1.6 to 1.8 mm long; first patella and tibia, 1.8 to 2.3 mm. Males vary from 2.6 to 3.2 mm in total length; carapace, 1.6 to 1.9 mm long; first patella and tibia, 2.2 to 2.7 mm.

Diagnosis. This species differs from others by the shape of the chelicerae (Figs. 3, 11), by the embolus and paracymbium in the small palpus (Figs. 14, 15), and by the shape of the ducts and seminal receptacles in the female (Fig. 5).

Natural History. This forest species makes its web between tree roots, just above the ground and at an angle nearly horizontal. Behind the web a vertical line of debris hangs from an upper frame thread, held together by silk and including egg-sacs (arrows, Plate 2). According to W. T. Sedgwick (personal communication), the spider rests at night in the hub of the web. During daytime the spider is among the line of debris. The species is probably much more common than records indicate; unless one especially searches for it, it is overlooked. The web is about 6 to 12 cm in diameter (Plate 2). Mature males and females can be found all summer.

Distribution. Southeastern states (Map 1). The northernmost record is from Little Grand Canyon, Jackson Co., Illinois, from several collections (J. Beatty).

Tetragnatha Latreille

Tetragnatha Latreille, 1804, Tableau méthodique des insectes, in Nouveau Dictionnaire d'Histoire Naturelle, 24: 135 (unavailable). Type species by monotypy is *T. extensa*. The name is feminine.

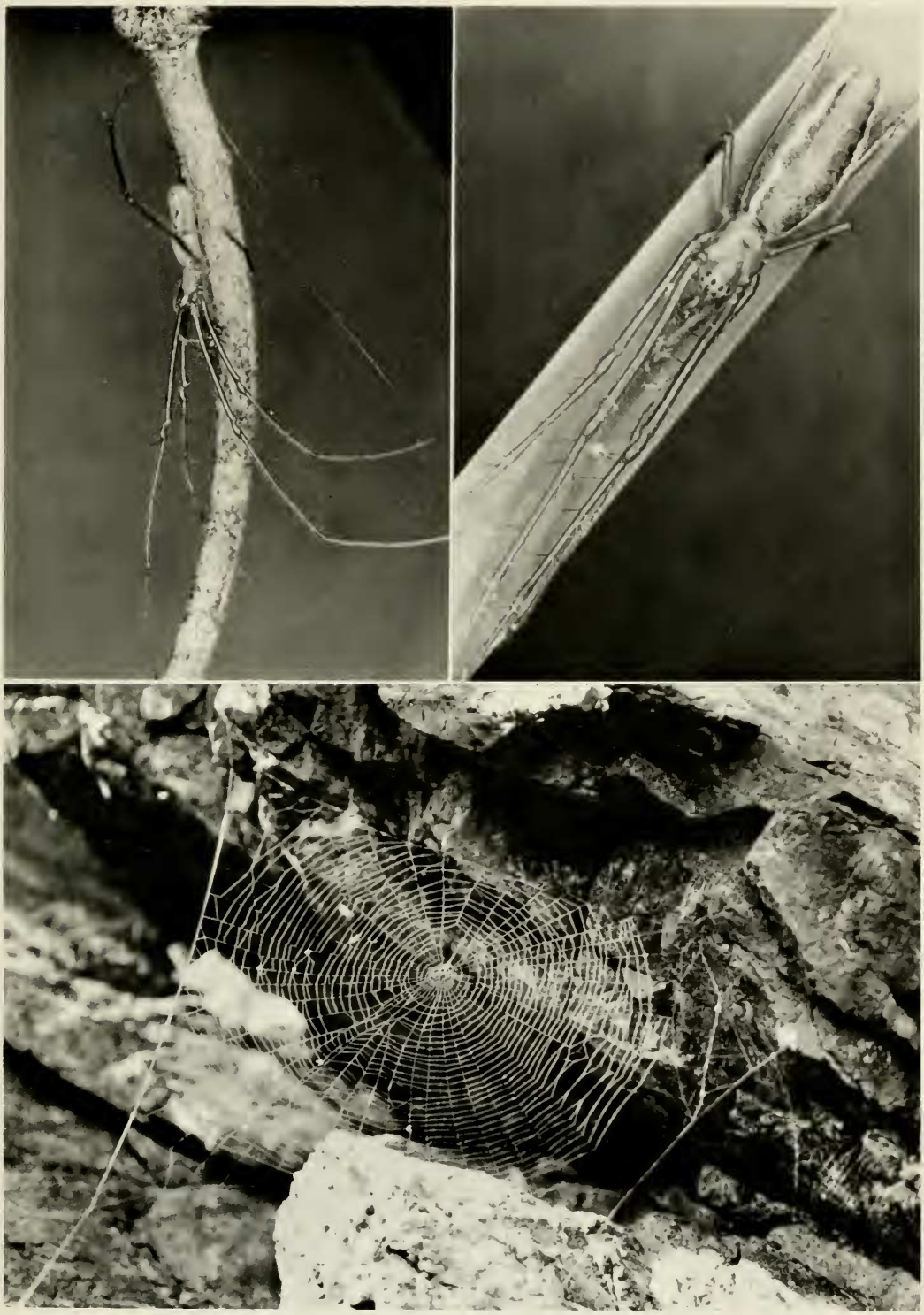
Eugnatha Audouin in Savigny, 1825, Explications sommaires des Planches d'Arachnides de l'Egypte et de la Syrie, p. 119. New name for *Tetragnatha* (an objective synonym).

Eucta Simon, 1881, Arachnides de France, 5: 5. Type species by monotypy is *E. gallica*.

Arundognatha Wiehle, 1963, Tetragnathidae in

→

Plate 3. Upper left, male *Tetragnatha versicolor*, Michigan; upper right, female *T. viridis*, Cape Cod; bottom, web of *T. versicolor* with closed hub, Friday Harbor, Washington (web photo B. Opell).



Tierwelt Deutschlands, 49: 47. Type species *T. striata* L. Koch designated by Wiehle.

Note. The characters that separate *Eucta* and *Arundognatha* from *Tetragnatha* are not those of distinct groups. The two North American species with tails (=*Eucta*), *T. caudata* (Figs. 140–148) and *T. branda* (Figs. 167–175), are not closely related. Judging by similarity of genitalia, *T. caudata* is close to *T. pallescens*; both have the conductor tipped by a hook (Figs. 139, 148). *Tetragnatha branda* is close to *T. vermiformis*; both lack the pleat next to the conductor (Figs. 175, 184); females of both have the seminal receptacles on each side dorsoventral to each other (Figs. 170, 179).

Some rare specimens of *T. laboriosa* have the lateral eyes farther apart than medians, and could be included in *Arundognatha*. But, most have the lateral eyes slightly closer together than the medians. *Tetragnatha laboriosa*, judging by the genitalia, is close to *T. versicolor*, *T. viridis*, and *T. pallescens*. *Tetragnatha versicolor* always has the lateral eyes closer than the medians; *T. viridis*, the same distance apart; *T. pallescens*, always farther apart. All belong to the same species group.

Diagnosis. Tetragnatha differs from *Pachygnatha* and *Glenognatha* by lacking a tapetum in the lateral eyes (Figs. 21, 22); it differs from *Dolichognatha* as well as from the two previous genera by having an elongate to tubular-shaped abdomen (Fig. 23), usually with silver pigment. It further differs from *Dolichognatha* in lacking an epigynum and by having trichobothria on the femora (Fig. 17). It differs from *Leucauge* by lacking tapetum in the secondary eyes.

Description. Carapace slightly elongate, weakly sclerotized, lacking setae, and often with an indistinct median longitudinal gray band. Eyes on black spots. Sternum weakly sclerotized, surrounding coxae (Fig. 16). Chelicerae and legs yellowish white to brown. Abdomen silver, consisting of tiny pigment spots least dense on venter, most dense on dorsum. Dorsum either has gray or black folium, or lacks pigment and folium altogether; the venter may have a median longitudinal dark band.

Eyes closely grouped, lateral eyes less than two diameters from medians (Figs. 24, 31). The lateral eyes may touch, but more commonly are slightly separated or far apart, with the anterior lateral eyes having moved away in an anterior lateral direction (Figs. 177, 182). The placement of the eyes is somewhat variable within species. Clypeus height equals one to two diameters of anterior median eyes (Figs. 24, 130). Chelicerae more or less enlarged, often with complex teeth (Figs. 24, 25, 31). Labium rebordered (distally swollen); endites elongate and distally widened (Fig. 16). Legs very long, first longest, third shortest. Abdomen cylindrical, often swollen anteriorly (Fig. 23) or with sides almost parallel (Fig. 149); in some species a tail overhangs spinnerets (Figs. 140, 167).

Males are only slightly smaller than females. Male chelicerae are larger and more projecting than those of female, with a spur (apophysis) on anterior face to hold the female fang when mating (Figs. 31, 52). The chelicerae have a very long tooth (the main tooth) distally from a row of smaller teeth (Figs. 62, 80) (absent in *T. dearmata* and *T. pallescens*). These smaller teeth become progressively smaller proximally. Distal from the large tooth is a slanting tooth (Figs. 62, 80), and at the base of the fang a smaller knob called a fang guide (Locket and Millidge, 1953; Wiehle, 1963). The dentition is much more complex in many species (Figs. 24, 31).

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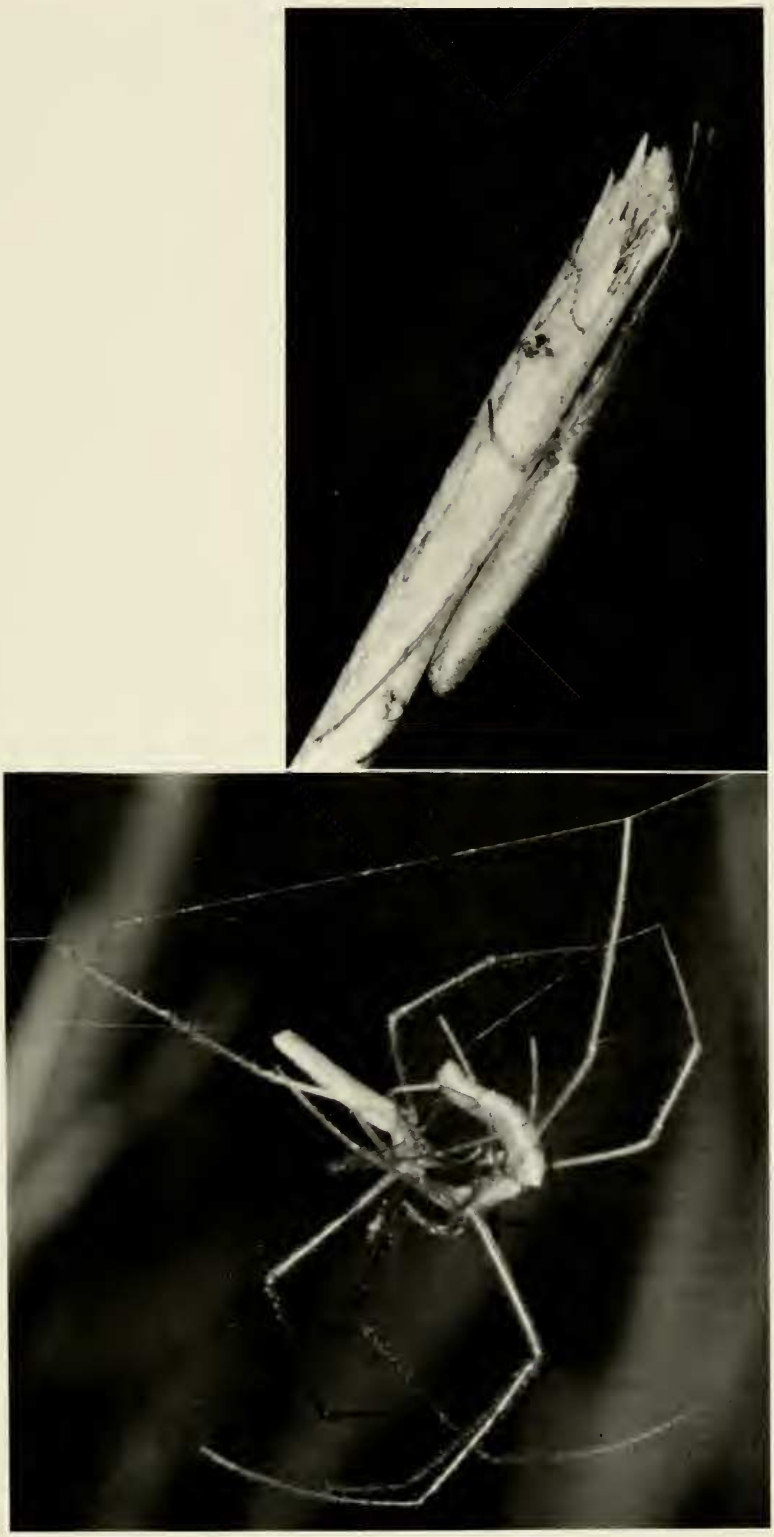
Plate 4. Above, female *Tetragnatha pallescens*, Florida; below, mating *T. straminea*, Massachusetts, male on left with left palpus inserted, right palpus held forward (photo J. Coddington).



There are trichobothria on each femur (Fig. 17). *Tetragnatha laboriosa* females have 13 trichobothria on the first femur, 11 on the second, 11 on the third, and 13 on the fourth. There are the usual trichobothria on the tibiae, and there is one trichobothrium on the third metatarsus.

Genitalia. The male palpus is slightly more complex than that of *Pachygnatha.* A spherical tegulum (T in Figs. 19, 20) encloses the duct. The duct makes only a single coil. The filiform embolus (E) is distally wrapped within a complex conductor (Figs. 19, 20). The cymbium (Y) appears more complex than that of other araneids; it is small and may be more or less lobed (Figs. 18–20). The paracymbium (P) is a separate sclerite (Fig. 18) as in *Pachygnatha* and the family Linyphiidae.

The paracymbium (P) is straight, but usually has a small lobe on the lateral cymbium side (Fig. 18). *Tetragnatha guatemalensis* and *T. earmra* have a distal finger projecting from the paracymbium (Figs. 44, 54); that of *T. nitens* has a large ventral transparent lobe and a distal notch (Fig. 33). In other species the paracymbium is not diagnostic.

The most complex part of the palpus is the conductor (C in Figs. 19, 20 and Plates 5–7), which often has pleats laterally (L in Fig. 45). These pleats are absent in *T. branda* (Fig. 175), *T. vermiformis* (Fig. 184), the European *T. striata,* and the cosmotropical *T. nitens* (Fig. 34). When expanded, it can be seen that the pleats enlarge, since they are hematodocha (C in Figs. 19, 20). The distal tip of the conductor is sclerotized and seems the most useful character for identifying species (Plates 5–7).

The female genitalia are quite similar to those of *Pachygnatha* (Levi, 1980a). There is no epigynum; the genital openings are at the posterior end of a median ventral lobe from the epigastric area (Fig. 26). The seminal receptacles are anterior, near the level of the lung spiracles; there are two on each side (Fig. 48), only one in *T. nitens* (Fig. 27). There is a median, lightly sclerotized structure, comprising the so-called median seminal receptacles (Figs. 27, 48), which probably hold the conductor when mating. The shape and position of the seminal receptacles are the most useful species diagnostic characters of females.

Species. There are *Tetragnatha* species on all continents and islands, and in arctic, temperate, and tropical climates.

Judging by the similarity of the genitalia, most of the North American species are closely related to each other: *elongata, versicolor, viridis, laboriosa, pallescens, caudata, straminea,* and probably *shoshone.* The cosmotropical *T. nitens* is distinct from any other species in the area: it has only two seminal receptacles (Fig. 27) and, like *T. vermiformis,* lacks the pleats on the palpal conductor (Fig. 34). *Tetragnatha vermiformis* (Figs. 176–184) and *T. branda* (Figs. 167–175) I believe are closely related to the European *T. striata. Tetragnatha guatemalensis* and *T. earmra* belong to a fourth group, judging by the more specialized paracymbium (Figs. 44, 54) and tip of the conductor (Figs. 45, 55). *Tetragnatha extensa* and *T. dearmata* are closest to the first group mentioned and perhaps to Old World relatives of the *T. versicolor* group.

Species that have the lateral eyes relatively close together also have the largest amount of black pigment, and have the abdomen swollen anteriorly. Species that have the lateral eyes far apart tend to have less dark pigment; the abdomen tends to be tubular and silvery.

Diagnostic Species Characters. The best characters to separate species are: in males, the shape of the conductor tip (Plates 5–7); in females, the shape and position of the seminal receptacles, which can be seen only after lifting the exoskeleton of the genital lobe on one side (see Methods of Study). Coloration, amount of black pigment, and the distance between the lateral eyes are help-

ful. The chelicerae, faithfully illustrated by earlier authors, have unique characters in only a few species.

However, the separation of *Tetragnatha* species is still reasonably difficult. While the distance between lateral eyes compared with the distance between medians is an excellent superficial character, there is considerable variation within species, perhaps most noticeable in *T. laboriosa*. Most *T. laboriosa* have the lateral eyes slightly closer together than the medians, but some have them the same distance apart, and in some specimens they are slightly farther apart.

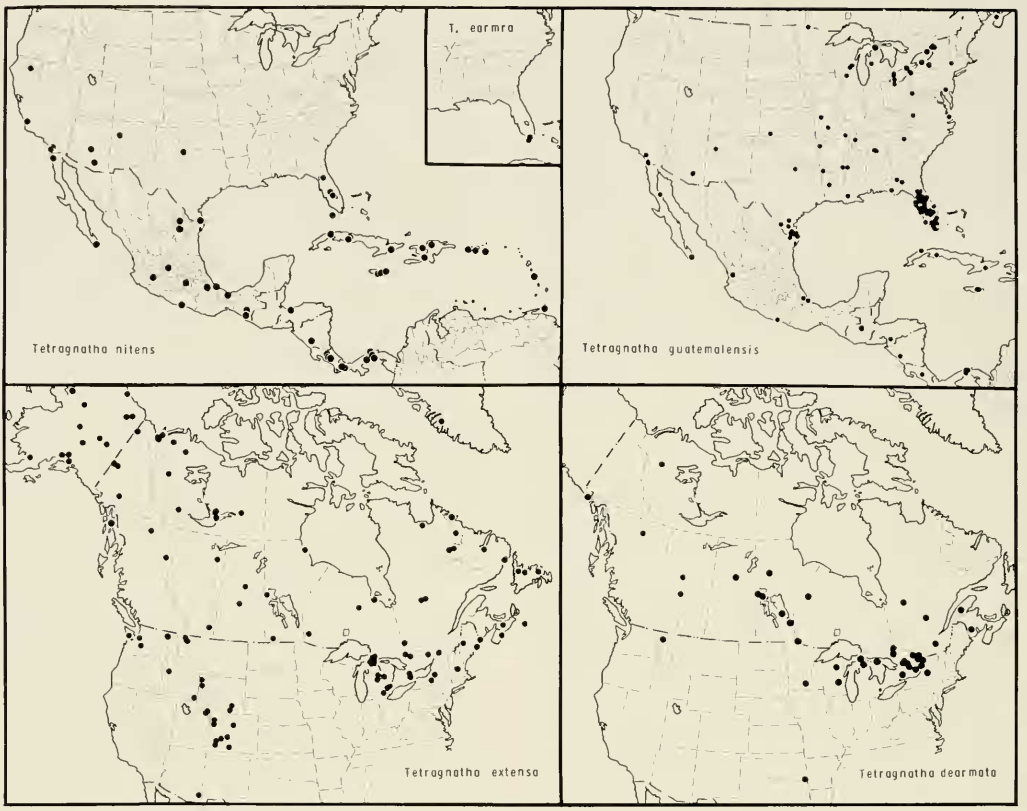
Many of the old North American published records of *Tetragnatha* species were based on determinations of juvenile specimens or adults, using chelicerae, and are in error.

Natural History. Most *Tetragnatha* species are found near water. Some may seem rare only because spider collectors are generally terrestrial (e.g., *T. branda* and *T. vermiformis*). The most abundant species in collections, *T. laboriosa* and *T. versicolor,* are the two species living farthest away from water. Several species have very specialized habitats: *T. viridis* is found in conifers, especially pines; the European *T. pinicola* is also found in trees. The rarity of *T. viridis* may reflect its reluctance to drop within reach. *Tetragnatha branda* has been collected only from salt marshes.

The orb-web ranges from horizontal to vertical. The hub, usually but not always open (Plate 3), is cut out after the web is completed (Wiehle, 1963). The spider rests on a plant or in the middle of the web, legs extended in a paraxial direction (Plates 3, 4). The web of *T. laboriosa* is made in the evening, before nightfall (Le Sar and Unzicker, 1978), as is the web of *T. nigrita* (Wiehle, 1963), and perhaps of other species as well. According to Crome (1954), *Tetragnatha kaestneri* (= *Eucta kaestneri*) does not make a scaffolding before the viscid spiral.

Tetragnatha laboriosa makes its web only when temperatures are warm and it is not windy. It seeks a new location each night; the web size is controlled by the physical dimensions of the space between vegetation. The spiders feed most actively from sundown until just after dark (Le Sar and Unzicker, 1978). *Tetragnatha* feed nonselectively on dipterans, but Le Sar reports that their *T. laboriosa* also feeds on Miridae and Cicadellidae. The importance of *Tetragnatha* as a mosquito predator has been described in papers by Łuczak and her colleagues (1966, 1968, 1970). Adults of North American species are found almost all summer, and live for the season; perhaps there are two generations in summer (Le Sar and Unzicker, 1979). The males are almost as common as females, and therefore must have a similar life span.

There is no obvious courtship. The male grasps the female's chelicerae with his fangs (Plate 4); the coupling is apparently so secure that no holdfast organ is necessary adjoining the copulatory opening (epigynum). Perhaps this is the circumstance that has permitted the loss of the epigynum. The female may coil her abdomen while mating. Palpi are alternated, as in most entelegyne spiders (Plate 4). Unlike most other Araneidae, the male does not court between the use of left and right palpi. Like haplogyne spiders and Palpimanidae, males may use both palpi together in sperm induction. A week after mating, the female may produce several egg-sacs, fluffy structures broadly attached to vegetation. The young hatch soon thereafter and overwinter in immature stages. Adults of the specialized *T. viridis* are only found in late spring. In one instance a late August young was raised. It readily fed on the drosophila flies which were caught without web (in a vial) and matured in December in the laboratory after two molts. As an adult male, it continued to feed on drosophila flies. Łuczak and Dąbrowska-Prot (1966) also describe the ability of



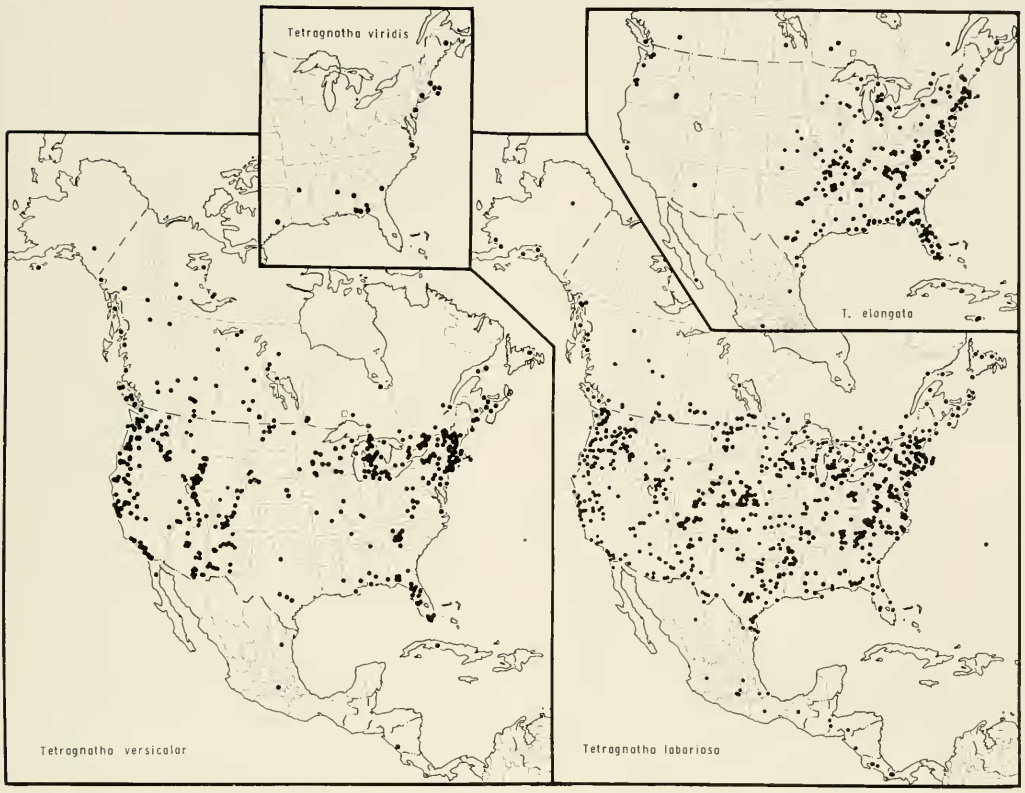
Map 2. Distributions of *Tetragnatha nitens* (Audouin), *T. earmra* n. sp., *T. guatemalensis* O. P.-Cambridge, *T. extensa* (Linnaeus), and *T. dearmata* Thorell in North America.

Tetragnatha to catch flies without the use of webs.

Key to Species. The distance of the lateral eyes from each other compared to the distance of the median eyes is an easy character to see. The distance is measured from the center of the eyes. Unfortunately there is considerable variation, especially in the commonest species, *T. laboriosa*. While in most specimens of this species the lateral eyes are slightly closer together than the medians or an equal distance apart, in a very rare specimen the eyes are very slightly farther apart.

KEY TO FEMALE *TETRAGNATHA* NORTH OF MEXICO

1. Lateral eyes farther apart than medians (Figs. 130, 141, 150, 159, 168, 177) 2
– Lateral eyes as far apart as medians or closer together (Figs. 24, 36, 75, 111) 7
2(1). Abdomen with a tail extending beyond spinnerets (Figs. 140, 167) 3
– Abdomen without a tail (Figs. 129, 176) 4
3(2). Anterior median seminal receptacles closer to each other than to other member of pair (Figs. 142, 143); Canada, Northwest, eastern states (Map 4) ..... *caudata*
– Anterior and posterior seminal receptacles on each side next to each other (Figs. 169, 171); New England to Gulf Coast (Map 4) ..... *branda*
4(2). Abdomen only silver on dorsal half, edge of silvery area forming a lateral line with area below lacking silver pigment (Fig. 149); seminal receptacles on each side about 1 to 2 times their diameter apart and connected by a stalk (Fig. 153); Alberta, Utah, and East (Map 4) ..... *straminea*



Map 3. Distributions of *Tetragnatha elongata* Walckenaer, *T. versicolor* Walckenaer, *T. viridis* Walckenaer, and *T. laboriosa* Hentz.

– Abdomen all silvery, except for midventer (Fig. 158); seminal receptacles otherwise (Fig. 162) 5

5(4). Seminal receptacles elongate, paraxial, and members of a pair on top of one another (Figs. 178, 180); abdomen at most 3 times longer than wide or high (Fig. 176); Ontario, northwest to Florida (Map 4) ..... *vermiformis*

– Seminal receptacles pear-shaped and side by side (Figs. 131, 133, 160, 162); length of abdomen about 4 or 5 times width or height (Figs. 129, 158) 6

6(5). Members of pair of seminal receptacles on each side almost touching (Fig. 162); Great Slave Lake, Ontario, Indiana to Pacific (Map 4) ..... *shoshone*

– Members of pair of seminal receptacles on each side separated by an intermediate lobe (Fig. 133); widespread (Map 4) ..... *pallescens*

7(1). Genital cover twice as long as wide, narrowed anteriorly, posterior rim notched (Fig. 26); only two seminal receptacles (Fig. 27); Florida, Texas, California (Map 2) ..... *nitens*

– Genital cover square or wider than long (Figs. 49, 77); four seminal receptacles (Figs. 50, 69, 78) 8

8(7). Lateral eyes about as far apart as medians or slightly closer together (Figs. 57, 111, 121) 9

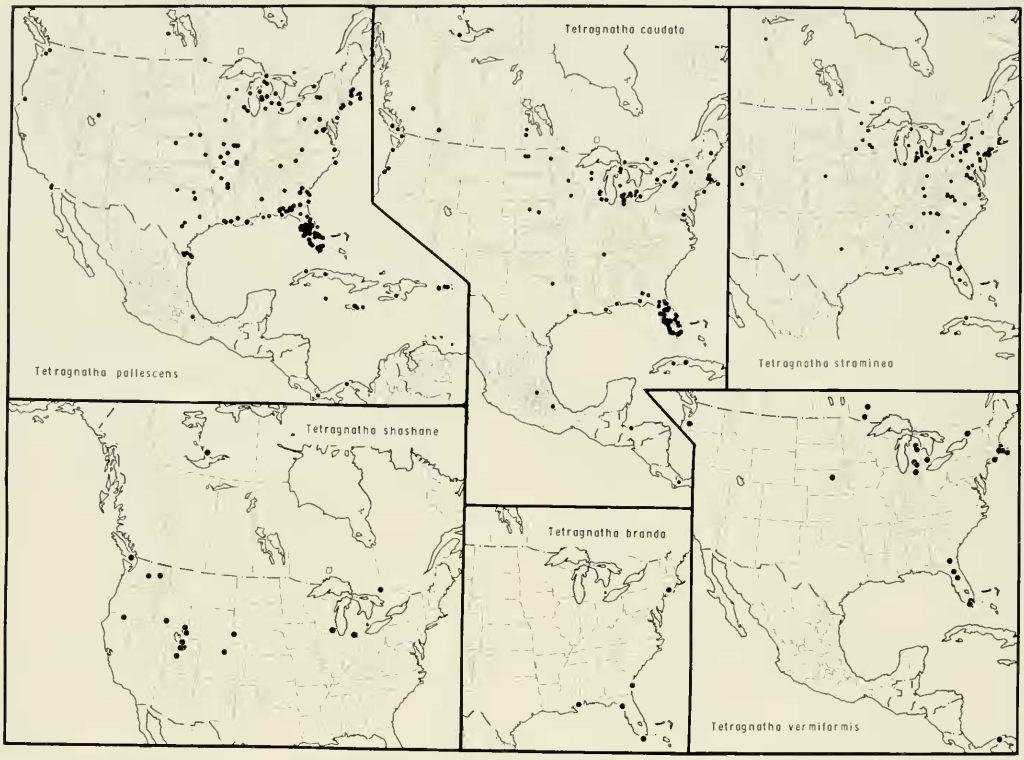
– Lateral eyes clearly closer together than medians (Figs. 47, 66, 75, 91) 11

9(8). Green; first and second tibial macrosetae length 3 to 5 times diameter of article (Fig. 115); New Brunswick to eastern Texas (Map 3) ..... *viridis*

– Silvery and yellowish white; macrosetae length at most 3 times diameter of article 10

10(9). Prominent pouch between pair of seminal receptacles hiding anterior one in ventral view; posterior seminal receptacle pear-shaped (Fig. 124); widespread (Map 3) ..... *laboriosa*

– No pouch between members of pair of seminal receptacles; posterior seminal



Map 4. Distributions of *Tetragnatha pallescens* F. P.-Cambridge, *T. caudata* Emerton, *T. straminea* Emerton, *T. shoshone* n. sp., *T. branda* n. sp., and *T. vermiformis* Emerton.

receptacle elongate and transverse (Fig. 60); Alaska, Canada, northeastern states, Rocky Mountains (Map 2) ... *extensa*

11(8). Anterior seminal receptacles of each pair elongate, paraxial, parallel to receptacle of other pair (Figs. 76, 78); widespread (Map 2) ..... *elongata*

– Anterior seminal receptacles oval or pear-shaped; if elongate, not placed parallel (Figs. 39, 69) 12

12(11). Seminal receptacles of each pair on top of one another, paraxial (Figs. 39, 50) 13

– Seminal receptacles of each pair side by side (Figs. 69, 94) 14

13(12). Seminal receptacles elongate-oval (Fig. 50); widespread (Map 2) ..... *guatemalensis*

– Seminal receptacles subspherical (Fig. 39); Everglades and Florida Keys (Map 2) ..... *earmra*

14(12). Posterior lateral seminal receptacle of each pair U-shaped (Fig. 69); Alaska to northern States (Map 2) ..... *dearmata*

– Posterior lateral seminal receptacle of each pair oval (Fig. 94); widespread (Map 3) ..... *versicolor*

Key to Male *Tetragnatha* North of Mexico

1. Lateral eyes farther apart than medians (Figs. 137, 146, 155, 164, 173, 182) 2

– Lateral eyes as far apart as medians or closer together (Figs. 31, 52, 71, 80, 126) 7

2(1). Abdomen with a tail extending beyond spinnerets (Figs. 145, 172) 3

– Abdomen without tail (Figs. 136, 181) 4

3(2). Conductor with lateral pleats (Figs. 147, 148); tip bird head-shaped with a lateral spur (Fig. 148; Plate 7c); Canada, northwest to eastern states (Map 4) ..... *caudata*

– Conductor without lateral pleats (Figs. 174, 175), tip with lateral notch (Fig. 175; Plate 7g, h); New England to Gulf Coast (Map 4) ..... *branda*

4(2). Conductor without pleats (Figs. 183, 184); tip tapering to a point, small, bent over (Fig. 184; Plate 7i); Ontario, northwest to Florida (Map 4) ..... *vermiformis*

– Conductor with pleats (Figs. 138, 139); tip large with a neck (Figs. 138, 166) 5

5(4). Tip of conductor a large recurved hook (Fig. 139; Plate 7a); widespread (Map 4) ..... *pallescens*

– Tip of conductor not a large recurved hook (Figs. 157, 166) 6

6(5). Tip of conductor with a narrow neck (Figs. 156, 157; Plate 7d); only dorsal half of abdomen silver (Fig. 154); Alberta, Utah, and East (Map 4) ..... *straminea*

– Tip of conductor with a wide neck (Figs. 165, 166; Plate 7e, f); abdomen except for midventer all silver (Fig. 163); Great Slave Lake, Ontario, Indiana to Pacific (Map 4) ..... *shoshone*

7(1). Paracymbium with distal notch or with distal finger (Figs. 33, 44, 54) 8

– Paracymbium not modified, distally rounded (Figs. 18, 20, 81) 10

8(7). Paracymbium wide with distal notch (Fig. 33); conductor without pleats (Fig. 34; Plate 5a, b); Florida, Texas to California (Map 2) ..... *nitens*

– Paracymbium narrow with distal finger (Figs. 44, 54) 9

9(8). Chelicerae about half length or longer than carapace (Figs. 51, 52); conductor tip with lateral finger (Fig. 55; Plate 5d); widespread (Map 2) ..... *guatemalensis*

– Chelicerae about half carapace length (Figs. 40–42); tip of conductor crescent-shaped in ventral view, concave laterally (Fig. 45; Plate 5c); Everglades and Keys (Map 2) ..... *earmra*

10(7). Conductor tip with neck and sclerotized on lateral side, pointing laterally to side of paracymbium (Figs. 63, 64; Plate 5e); Alaska, Canada, northeastern states, Rocky Mountains (Map 2) ..... *extensa*

– Conductor tip pointed distally, recurved or pointing mesally (Figs. 73, 82, 128; Plates 5f, g, 6b, h) 11

11(10). Conductor tip bird head-shaped (Fig. 128; Plate 6h, i); pleat closest to conductor lifted up (Fig. 128); widespread (Map 3) ..... *laboriosa*

– Conductor tip otherwise (Figs. 73, 82, 98, 119); pleats' curvature about parallel to conductor (Figs. 73, 82) 12

12(11). Lateral eyes about as far apart as medians (Fig. 117); green; length of first and second tibial macrosetae 3 to 5 times diameter of article (Fig. 115); New Brunswick to eastern Texas (Map 2) ..... *viridis*

– Lateral eyes closer together than medians (Figs. 80, 96); silver-brown to gray; length of first and second tibial macrosetae at most 3 times diameter of article 13

13(11). Conductor tip tapering to a minute point, conductor concave laterally near tip (Fig. 82; Plate 5g, h); chelicerae usually longer than carapace (Figs. 79, 80); widespread (Map 3) ..... *elongata*

– Conductor tip otherwise (Figs. 73, 98); chelicerae usually shorter than carapace (Figs. 70, 71, 95, 96) 14

14(13). Conductor tip a pennant, pointing mesally (Figs. 72, 73; Plate 5f); Alaska to northern states (Map 2) ..... *dearmata*

– Conductor tip a recurved hook (Fig. 98, 105–109; Plate 6b–f); widespread (Map 2) ..... *versicolor*

Tetragnatha nitens (Audouin in Savigny)

Plate 5a, b; Figures 23–34; Map 2

Eugnatha nitens Audouin in Savigny, 1825, Explication sommaire des Planches d'Arachnides de l'Egypte et de la Syrie, p. 118, pl. 2, fig. 2, ♀. Specimens from near Rosetta [Rashid], Egypt, lost.

Eugnatha pelusia Audouin in Savigny, 1825, Explication sommaire des Planches d'Arachnides de l'Egypte et de la Syrie, p. 119, pl. 2, fig. 3, ♂. Specimen from island of Rosetta [Rashid], Egypt, lost. NEW SYNONYMY.

Tetragnatha andina Taczanowski, 1878, Horae Soc. Entom. Rossicae, 14: 144, pl. 1, fig. 2, ♀. Numerous female and male syntypes from Amable María, Prov. Tarma, Peru in the Polish Academy of Sciences, examined. NEW SYNONYMY.

Tetragnatha antillana Simon, 1897, Proc. Zool. Soc. London, p. 868. 13 male and 17 female and 5 juvenile syntypes from St. Vincent Island, Lesser Antilles, in the British Museum, Natural History, examined. Seeley, 1928, Bull. New York State Mus, 278: 105, figs. 1–4, ♀, ♂. Roewer, 1942, Katalog der Araneae, 1: 988. Chickering, 1957, Bull. Mus. Comp. Zool., 116:306, figs. 1–6, ♀, ♂; Breviora, 68: 2. Bonnet, 1959, Bibliographia Araneorum, 2: 4318. Chickering, 1962, Bull. Mus. Comp. Zool., 127: 428, figs. 1–6, ♀, ♂. NEW SYNONYMY.

Tetragnatha vicina Simon, 1897, Proc. Zool. Soc. London, p. 869. Three male syntypes from St. Vincent, Lesser Antilles in the British Museum, Natural History, examined. NEW SYNONYMY.

Tetragnatha peninsulana Banks, 1898, Proc. California Acad. Sci., ser. 3, 1: 246, pl. 15, fig. 12, ♀, ♂. Four female syntypes from San José del Cabo, Baja California in the Museum of Comparative Zoology, examined. Male syntype in California Academy of Sciences, destroyed. NEW SYNONYMY.

Tetragnatha galapagoensis Banks, 1902, Proc. Washington Acad. Sci., 4: 61, pl. 1, fig. 10, ♀, ♂. One male, one female syntype from Galápagos

Islands in the Museum of Comparative Zoology, examined. NEW SYNONYMY.

Tetragnatha aptans Chamberlin, 1920, Bull. Brooklyn Mus. Sci., 3: 41, figs. 7, 8, ♀. Female paratypes from Chincha Island, Peru in the Museum of Comparative Zoology, examined.

Tetragnatha eremita Chamberlin, 1924, Proc. California Acad. Sci., ser. 4, 12: 645, figs. 89, 90, ♂. Right male palpus of holotype from Puerto Escondido, Baja California in the Museum of Comparative Zoology, examined. NEW SYNONYMY.

Tetragnatha seminola Gertsch, 1936, Amer. Mus. Novitates, no. 852: 10, figs. 22, 23, ♂. Male Holotype from the northeast shore of Lake Okeechobee, Florida in the American Museum of Natural History, examined. NEW SYNONYMY.

Tetragnatha steckleri Gertsch and Ivie, 1936 Amer. Mus. Novitates, no. 858; 19, figs. 31–3?, ♀, ♂. Male holotype from Tucson, Arizona in the American Museum of Natural History, examined. NEW SYNONYMY.

Tetragnatha nitens:—Roewer, 1942, Katalog der Araneae, 2: 978. Bonnet, 1959, Bibliographia Araneorum, 2: 4345. Okuma, 1968, Acta Arachnologica, 21: 40, figs. 9–16, ♀, ♂.

Tetragnatha elmora Chamberlin and Ivie, 1942, Bull. Univ. Utah, biol. ser., 7(1): 62, fig. 160, ♀. Female holotype from Bluewater Lake, New Mexico in the American Museum of Natural History, examined. NEW SYNONYMY.

Tetragnatha festina Bryant, 1945, Bull. Mus. Comp. Zool., 95: 407, figs. 38, 39, 41, ♂ (not ♀). Male holotype from foothills of Cordillera Central, south of Santiago, Dominican Republic in the Museum of Comparative Zoology, examined. NEW SYNONYMY.

Tetragnatha haitensis Bryant, 1945, Bull. Mus. Comp. Zool., 95: 408, fig. 37, ♀. Female holotype from Ennery, Haiti in the Museum of Comparative Zoology, examined.

Note. Roewer (1942) cites the page of Savigny as 323 and the date as 1827. This is a later printing of the work. Plate 2c of Audouin in Savigny shows the diagnostic posterior cusp on the fang of the female. The posterior distal cheliceral teeth of the female are shorter in Audouin's illustration than those in our specimens. *Tetragnatha pelusia* has never before been synonymized with *T. nitens*, although the palpus and chelicerae are illustrated and the illustrations are more diagnostic than those of the female.

Variation. The length of the palpal tibia may be greater or less than the cymbium. The lateral eyes are sometimes as far apart as the medians, usually slightly closer together. On Panamanian specimens the diagnostic tooth at the posterior base of the fang is as long as the chelicerae are wide, and is sometimes smaller than illustrated on the most northern specimens. Total length of females, 7.4 to 11.0 mm; total length of males, 5.2 to 10.1 mm.

Diagnosis. Both sexes of this species are easily separated from other North American species. The lateral eyes are as far apart as the medians, sometimes closer together or, rarely, farther apart. There are gray pigment marks on the body (Fig. 23).

The paracymbium of the male palpus has a distal notch and a ventral transparent lobe (Fig. 33); the conductor lacks pleats along the distal edge (Plate 5a; Fig. 34).

The female chelicerae have a large posterior lateral tooth at the insertion of the fang (Figs. 24, 25) and a cusp posteriorly on the base of the fang (sometimes absent) (Fig. 25); the genital area is longer than wide, constricted anteriorly, with a notch above the opening (Fig. 26). Unlike all other North American species, there are only two seminal receptacles (Fig. 27). The female chelicerae are as long as the carapace or longer (Figs. 23, 24).

Natural History. The species has been collected above wet ground and near a creek in Mexico, and in woods in Puerto Rico.

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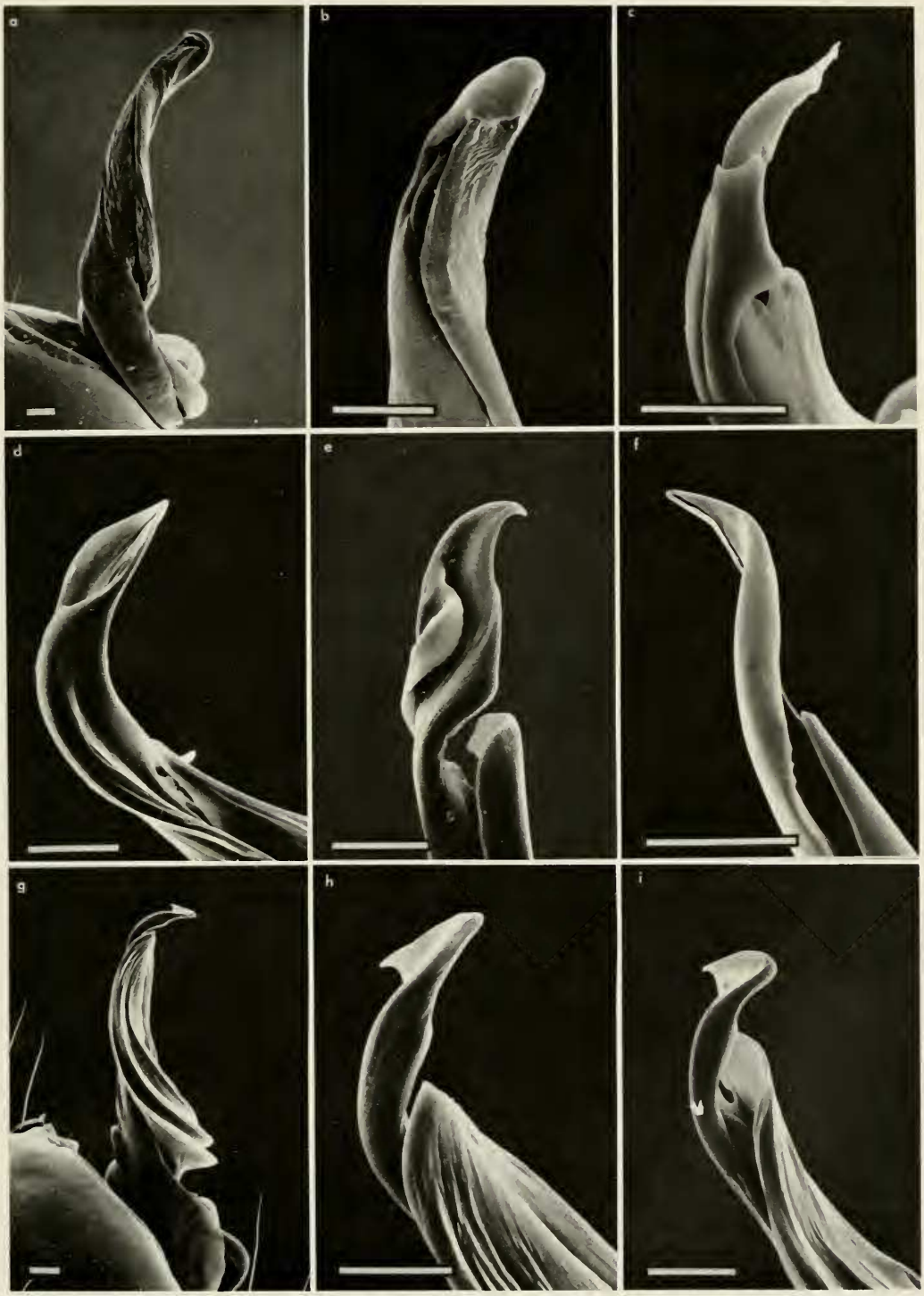
Plate 5. *Tetragnatha* male, left palpi; scanning electron micrographs of conductors and their tips. a, b, *T. nitens*, compare to Fig. 34. c, *T. earmra* (tip broken on right), compare with Fig. 45. d, *T. guatemalensis*, compare to Fig. 55. e, *T. extensa*, compare to Fig. 64. f, *T. dearmata*, compare to Fig. 73. g, i, *T. elongata*, compare to Fig. 82. (g, h, locality unknown; i, Florida). *Scale lines.* 0.05 mm.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Distribution. Cosmotropical, in North America north to northern Florida, northern Texas, New Mexico to northern California (Map 2). Since there are several similar species in tropical America, including *T. peruviana* Taczanowski and *T. piscatoria* Simon, *T. nitens* may have originated in South America.

Records. Florida. Alachua Co.: Gainesville; Newnan's Lake. Glades Co.: NE shore of Lake Okeechobee. Highlands Co.: Sebring. Monroe Co.: Johnston Key. *Texas.* Baylor Co.: Mabelle. Hidalgo Co.: Hargill. *New Mexico.* Valencia Co.: Bluewater Lake. *Arizona.* Maricopa Co.: Salt River near Blue Point. Pima Co.: Tucson. *California.* San Diego Co.: Escondido Reservoir; San Diego Mission. San Louis Obispo Co.: Atascadero Lake. Shasta Co.: McArthur.

The Museum of Comparative Zoology has specimens from several areas not shown on Map 2. *Galápagos Islands. Peru.* Chincha Isl. *Brazil.* Rio dos Macacos; Mendez; São Paulo. *Paraguay.* Río Paraná; 75 km NE Concepción; Hernandrías. *Madagascar. New Zealand.*

Tetragnatha earmra new species
Plate 5c; Figures 35–45; Map 2

Holotype. Male from Earmra South East Island, Everglades National Park, Florida, 28 January 1973 (A. Sheldon), in the Museum of Comparative Zoology. The name is an arbitrary combination of letters.[2]

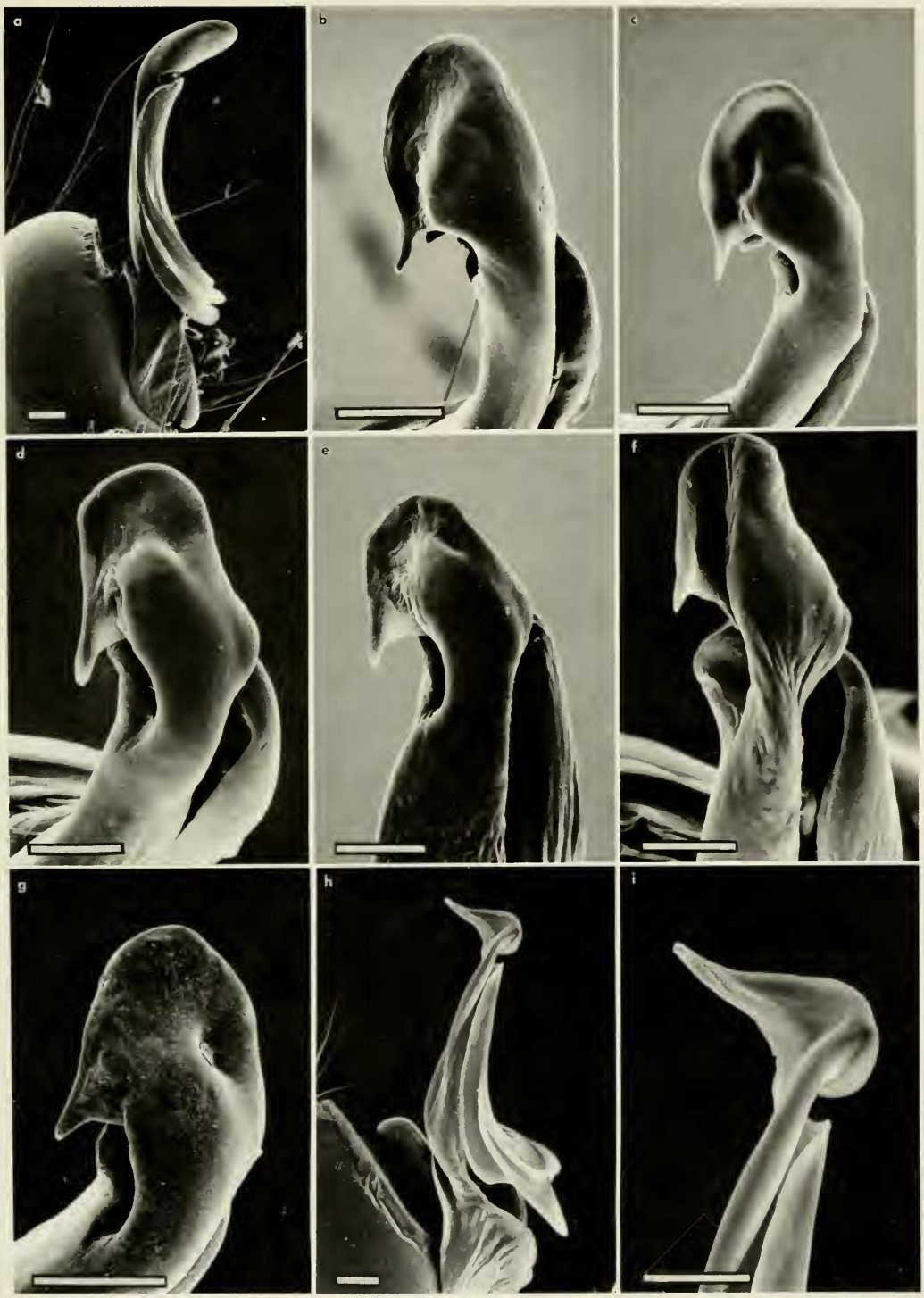
Description. Female. Carapace brown, head region darker. Chelicerae brown; labium dark, except for swollen area. Sternum dark brown, legs brown. Eyes with distinct black rings (Fig. 36). Dorsum and abdomen with several pairs of dark patches on sides (Fig. 35). Venter with black band having parallel sides (Fig. 35). The lateral eyes are closer to each other than the medians, and situated together on a tubercle (Fig. 36). Posterior eyes 0.8 diameters of anterior medians; anterior laterals 0.5 diameters of anterior medians. Anterior median eyes their diameter apart, slightly less than two diameters from laterals. Posterior median eyes about 4 diameters apart, slightly less than four diameters from laterals. Total length, 6.0 mm. Carapace, 1.9 mm long, 1.3 mm wide. First femur, 4.2 mm; patella and tibia, 5.1 mm; metatarsus, 4.3 mm; tarsus, 1.0 mm. Second patella and tibia, 2.7 mm; third, 1.1 mm; fourth, 2.4 mm.

Male. Male lighter colored than female. Diameter of posterior eyes 0.8 diameters of anterior medians. Anterior lateral eyes 0.6 diameters of anterior medians. Anterior median eyes their diameter apart, about 1.5 from laterals. Posterior median eyes about two diameters apart, about 1.8 from laterals (Figs. 41, 42). The chelicerae are not long, but the guide tooth has shifted anteriorly; the main tooth is the biggest (Figs. 41, 42). The base of the fang is attached to an area that seems narrow and projecting (Fig. 42). Total length, 3.8 mm. Carapace, 1.4 mm long, 0.9 mm wide. First femur, 3.1 mm; patella and tibia, 3.4 mm; metatarsus, 3.2 mm; tarsus, 0.9 mm. Second patella and tibia, 1.9 mm; third, 0.8 mm; fourth, 1.7 mm.

Diagnosis. Tetragnatha earmra has the lateral eyes closer together than the medians, and on a tubercle; there are large black rings around the eyes (Figs. 36, 41, 42).

[2] The exact location of Earmra South East Island could not be located in Everglades National Park. To avoid a name change, if Earmra turns out to be a misspelling, the name is considered an arbitrary combination of letters.

Plate 6. *Tetragnatha* male, left palpi; scanning electron micrographs of conductors and their tips; a–f, *T. versicolor*, compare to Figs. 98, 104–109. a, b, (Georgia); c, (Virginia), d, (Rhode Island); e, (Michigan); f, (California). g, *T. viridis*, compare to Fig. 119. h, i, *T. laboriosa*, compare to Fig. 128. *Scale lines.* 0.05 mm.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Like the larger *T. guatemalensis*, the paracymbium of the male has a distal bent finger (Fig. 44), but the tip of the conductor (Plate 5c; Fig. 45) appears twisted quite differently from that of *T. guatemalensis*.

The female has smaller chelicerae (Figs. 35, 36) than those of *T. guatemalensis*. There are two seminal receptacles, one behind the other on each side: one is lighter, ventral, pear-shaped and the other is darker, dorsal, more angular (Fig. 39). The seminal receptacles of *T. guatemalensis* are more elongate.

Paratypes. Florida. Everglades National Park: Paradise Key, 29 March 1951, ♂ (J. Vockeroth, CNC); Pineland Trail, 21 June 1964, ♀ (K. J. Stone, FSCA) (Map 2).

Tetragnatha guatemalensis O. P.-Cambridge

Plate 5d; Figures 46–55; Map 2

Tetragnatha guatemalensis O. P.-Cambridge, 1889, Biologia Centrali-Americana, Araneidea, 1: 8, pl. 2, figs. 6, 7, ♀, ♂. Male lectotype here designated from Guatemala [Cahabon or Laguna de los Coheteros near Cobán] in the British Museum, Natural History, examined. F. P.-Cambridge, 1903, Biologia Centrali-Americana, Araneidea, 2: 431, pl. 40, figs 12, 13, ♀, ♂. Chickering, 1959, Bull. Mus. Comp. Zool., 119: 482, figs. 13–21, ♀, ♂. Bonnet, 1959, Bibliographia Araneorum, 2: 4334.

Tetragnatha banksi McCook, 1893, American Spiders, 3: 262, pl. 25, fig. 6, pl. 28, fig. 4, ♂. Types from Florida and Wisconsin in the Academy of Natural Sciences, Philadelphia, lost.

Tetragnatha intermedia Banks, 1898, Proc. California Acad. Sci., ser. 3, 1: 247, pl. 15, fig. 14, ♂. One female, two male syntypes from Tepic, Mexico in the Museum of Comparative Zoology, examined, NEW SYNONYMY.

Tetragnatha seneca Seeley, 1928, Bull. New York State Mus., 178: 134, pl. 4, figs. 44–48, ♀, ♂. Male, female syntypes from Lodi Landing, Seneca Lake, New York in the American Museum of Natural History, examined. Kaston, 1948, Bull. Connecticut Geol. Natur. Hist. Surv., 70: 271, fig. 872, ♀. Bonnet, 1959, Bibliographia Araneorum, 2: 4355.

Tetragnatha laudativa Gertsch and Mulaik, 1936, Amer. Mus. Novitates, no. 863: 15, fig. 33, ♂ (only). Male holotype from Kingsville, Texas in the American Museum of Natural History, examined. NEW SYNONYMY.

Variation. The male chelicerae are at times as long as the carapace, sometimes shorter. Total length of females, 5.4 to 11.5 mm; males, 5.2 to 10.2 mm.

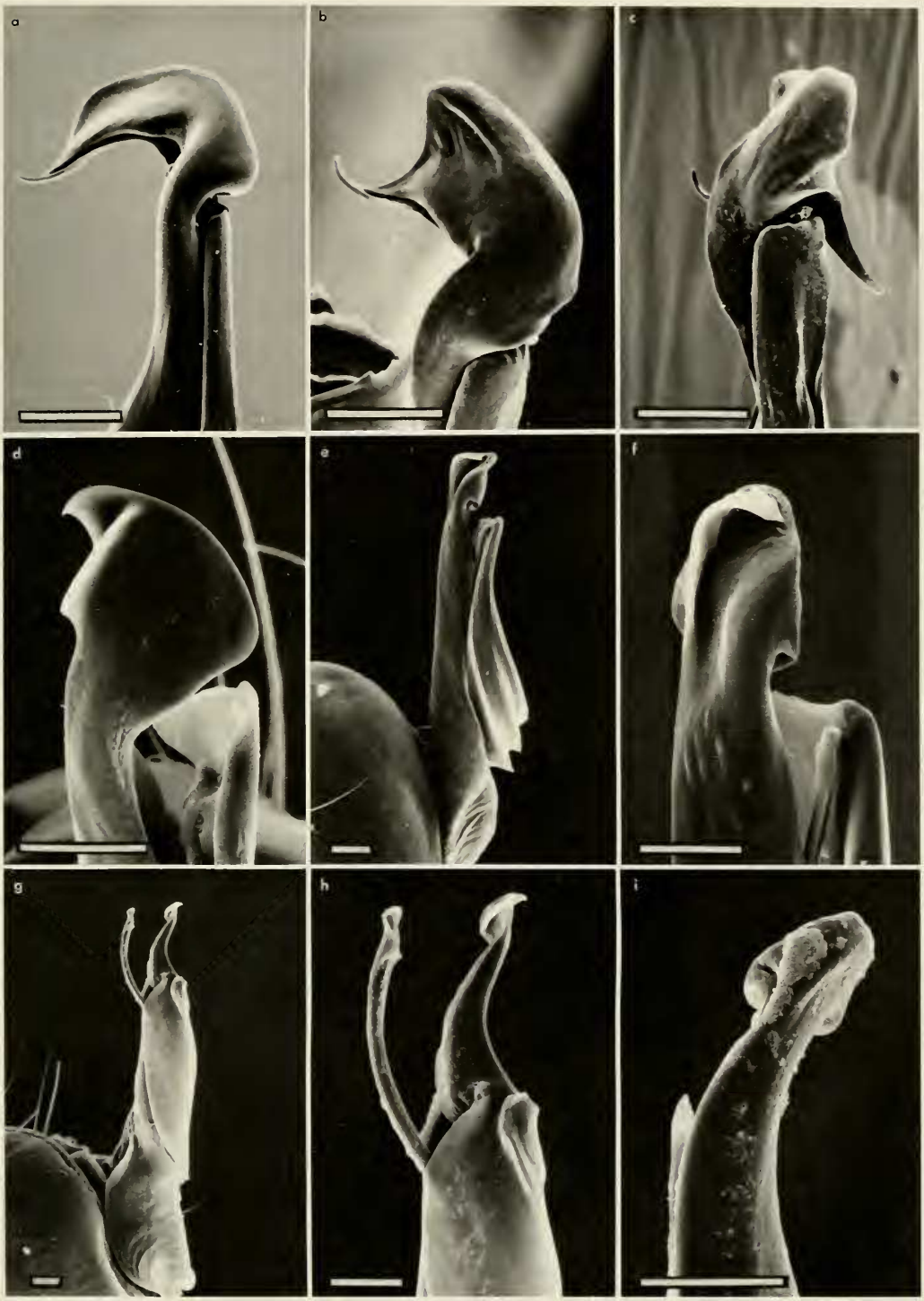
Diagnosis. This species has the lateral eyes always closer together than the medians and has a variable amount of dusky gray to black markings.

The male can readily be separated from that of other species except *T. earmra* by the presence of a finger extending from the tip of the palpal paracymbium (Figs. 53, 54); from *T. earmra* by the narrow lateral (in ventral view) extension on the tip of the conductor, straight or convex laterally (Plate 5d; Fig. 55). In contrast, that of *T. earmra* is concave laterally.

The female can only be separated from *Tetragnatha versicolor* and *T. dearmata* by examining the seminal receptacles: each member of the pair is oval, paraxial in position; one is dorsal and slightly to the side of the other (Fig. 50). The seminal receptacles are longer (Fig. 50) than the similar but more spherical ones of *T. earmra*. *Tetragnatha guatemalensis* has longer chelicerae (Figs. 46, 47) than *T. earmra*.

Natural History. Specimens have been collected from herbs; vegetation along marsh trail; sumac (*Rhus*) foliage and red pine (*Pinus resinosa*) in Ontario; sweeping honeysuckle (*Lonicera*) in West Virginia; and pine trees and web along grassy lakeshore in Wisconsin. In Florida specimens have been collected from weeds bordering streams; Australian

Plate 7. *Tetragnatha* male, left palpi: scanning electron micrographs of conductors and their tips; a, *T. pallescens*, compare to Fig. 139. b, c, *T. caudata*, compare to Fig. 148. d, *T. straminea*, compare to Fig. 157. e, f, *T. shoshone*, compare to Fig. 166. g, h, *T. branda*, compare to Fig. 175. i, *T. vermiformis*, compare to Fig. 184. *Scale lines.* 0.05 mm.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pine (*Casuarina*); garden vegetation; tangerine tree; orange grove; and citrus grove. All these habitats were probably near the edge of rivers, lakes, and other water.

Distribution. Nova Scotia, Minnesota, Kansas, New Mexico, Southern California, south to Panama, Cuba, Jamaica. Border records are: Annapolis Royal, Nova Scotia, 1 Aug. 1971, ♂ (C. D. Dondale); Rocky Point, Lake of the Woods Co., Minnesota, ♂ (B. Cutler); Meade County State Park, Kansas, ♀, ♂ (W. Ivie); Bluewater Lake, 4 Sept. 1941, ♀ (W. Ivie); Sabino Canyon, Pima Co., Arizona, Sept. 1952, ♂; San Diego Co., California (several records) (Map 2).

Tetragnatha extensa (Linnaeus)
Plate 5e; Figures 56–64; Map 2

Aranea extensa Linnaeus, 1758, Systema Naturae, 10th ed., p. 621. Specimens from Sweden.

Tetragnatha extensa:—Tullgren, 1947, Entomol. Tidskr., 68: 130, figs. 1, 2, 7, 8, 16, 17, 19, 20, ♀, ♂. Locket and Millidge, 1953, British Spiders, 2: 100, figs. 64a, b, 66a, 67a, 68a, 69b, ♀, ♂. Wiehle, 1963, Tierwelt Deutschlands, 49: 12, fig. 5, web, figs. 13–19, ♀, ♂, egg-sac. Bonnet, 1959, Bibliographia Araneorum, 2: 4323 (in part only).

Tetragnatha manitoba Chamberlin and Ivie, 1942, Bull. Univ. Utah, biol. ser., 7(1): 61, figs. 153–158, ♀, ♂. Male holotype from Churchill, Manitoba in the American Museum of Natural History, examined.

Tetragnatha rusticana Chickering, 1959, Bull. Mus. Comp. Zool., 119: 489, figs. 36–40, ♀, ♂. Male holotype from Bay County, Michigan in the Museum of Comparative Zoology, examined. NEW SYNONYMY.

Note. Most American citations to the name *T. extensa* are misidentifications and actually refer to *T. versicolor.*

Variation. The female fang may have a cusp on its base (Fig. 57), or this may be absent. The distal tooth on the posterior margin of the chelicerae of females may be asymmetrical or may have a cusp. There may be a diastema behind this tooth, or this may be absent. One female examined from Colorado had one on one side, not on the other. Total length of females, 5.8 to 8.7 mm; males, 4.3 to 7.6 mm.

Diagnosis. The lateral eyes are almost as far apart as the medians (Figs. 57, 62). The male has the chelicerae slightly shorter than the length of the carapace (Fig. 61), the female considerably shorter (Fig. 56).

The male can readily be separated from *T. versicolor, T. shoshone,* and other North American species by the tip of the conductor, which is sclerotized laterally with the tiny tip pointed laterally toward the paracymbium (Plate 5e; Figs. 63, 64).

The female generally has a black sternum. The dorsum of the abdomen is silvery; the venter of the abdomen has a black band bordered on each side by a narrower, bright silver band. The posterior seminal receptacles of each pair are longer than the anterior and in a transverse position (Figs. 58, 60).

Natural History. This species has been collected sweeping the understory of aspen woods in British Columbia and Colorado, and also in wet meadows in Mon-

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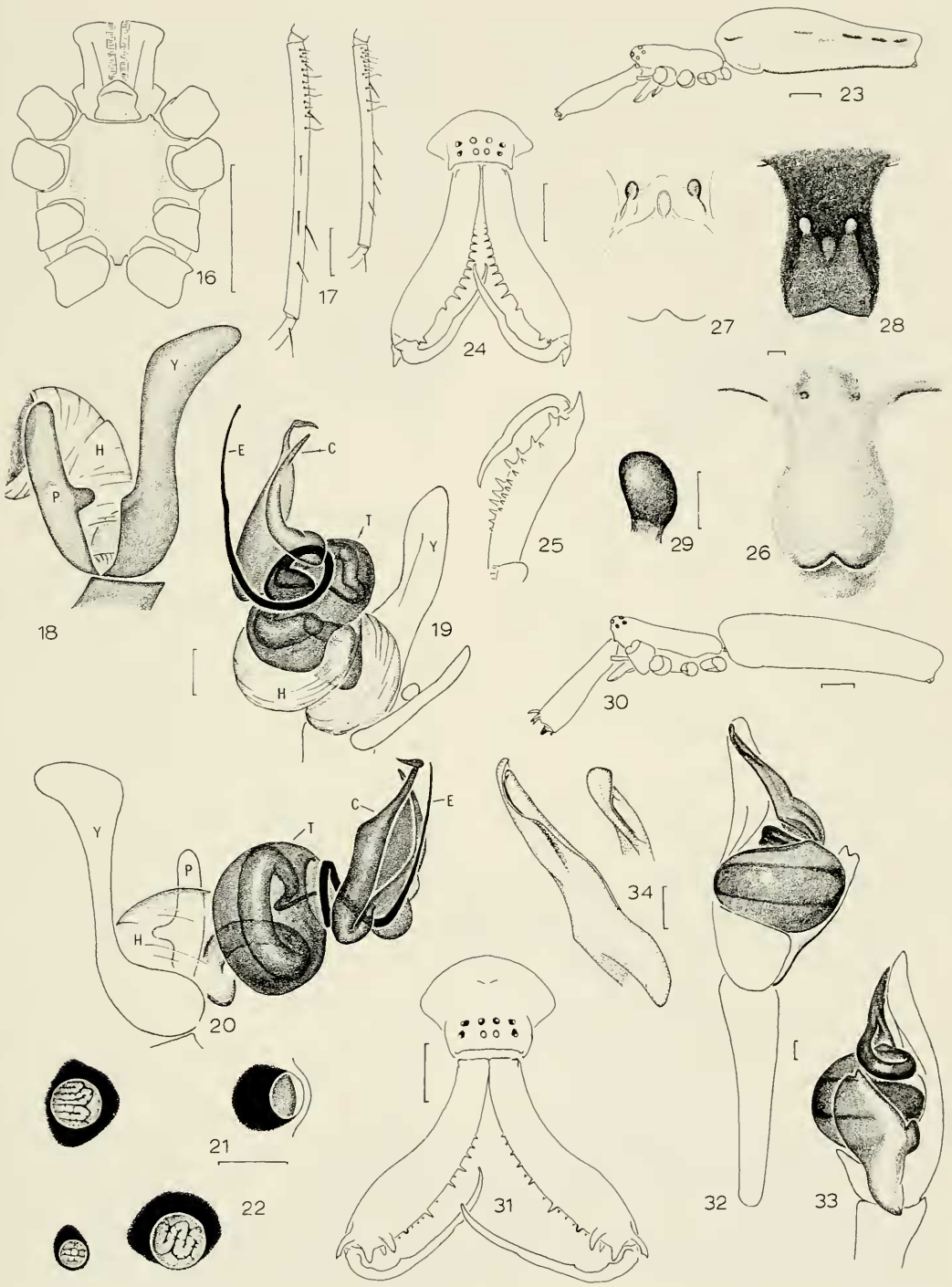
Figures 16–22. Morphology of *Tetragnatha laboriosa.* 16. Sternum, labium, coxae, and endites of male. 17. Left femora of female, legs one and four, showing trichobothria, prolateral. 18–22. Male. 18–20. Left palpus, expanded. 18. Cymbium and paracymbium, lateral. 19. Subventral. 20. Mesal. 21. Posterior median eyes. 22. Left lateral eyes.

Figures 23–34. *Tetragnatha nitens* (Audouin). 23–29. Female. 23. Lateral, without legs. 24. Chelicerae and eye region. 25. Left chelicera from below. 26–29. Genital area. 26. Ventral. 27. Dorsal. 28. Ventral, cleared. 29. Left seminal receptacle, ventral. 30–34. Male. 30. Lateral. 31. Chelicerae and eye region. 32–34. Left palpus. 32. Ventral. 33. Lateral. 34. Conductor and embolus, ventral, and conductor tip, mesal.

Scale lines. 0.1 mm; except Figs. 16, 17, 23–25, 30, 31, 1.0 mm.

Abbreviations. C, conductor; E, embolus; h, hematodocha; P, paracymbium; T, tegulum; Y, cymbium.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tana, Wyoming, and Colorado. It occurs up to timberline in the Colorado Rocky Mountains, about 3000 m elevation.

Distribution. Circumboreal, south to Maine, New Hampshire, New York, Michigan; in Rocky Mountains south to Chiricahua Mts., in the West to Idaho and Washington (Map 2). The southernmost record is from Herb Martyr Dam, Chiricahua Mts., Cochise Co., Arizona, ♀, 1 Sept. 1956 (A. F. Archer).

Tetragnatha dearmata Thorell
Plate 5f, Figures 65–73; Map 2

Tetragnatha dearmata Thorell, 1873, Remarks on Synonyms of European Spiders, p. 462. Specimens from Sweden. Tullgren, 1947, Entomol. Tidskr., 68: 139, figs. 32–44, ♀, ♂. Wiehle, 1963, Tierwelt Deutschlands, 49: 41, figs. 65–74, ♀, ♂. Bonnet, 1959, Bibliographia Araneorum, 2: 4321. Holm, 1973, Zool. Scripta, 2: 98.

Tetragnatha harrodi Levi, 1951, Amer. Mus. Novitates, no. 1501: 17, figs. 32–37, ♂. Male holotype from Harrowell, Prince Edward County, Ontario in the American Museum of Natural History. Chickering, 1959, Bull. Mus. Comp. Zool., 119: 484, figs. 22–25, ♀, ♂. NEW SYNONYMY.

Variation. Total length of females, 5.2 to 10.0 mm; total length of males, 5.9 to 6.8 mm.

Diagnosis. The lateral eyes are always much closer together than the medians (Figs. 66, 71).

Male *Tetragnatha dearmata* can be confused with *T. elongata*. However, the chelicerae of *T. dearmata* are shorter than the carapace (Fig. 70); *T. dearmata* lacks the first large (main) tooth on the anterior margin, and the tooth closest to the base of the fang is larger (Fig. 71). The similar European *T. montana* male has a large main tooth. The tibia of the palpus is shorter than the cymbium (Fig. 72). Unlike that of *T. elongata*, the middle of the conductor appears to have a thin fold; there is no basal, lateral, transparent shield on the conductor; and the tip of the conductor is a pennant, bent about 45° (Plate 5f; Figs. 72, 73).

The female is separated from *T. elongata* by the smaller chelicerae with fewer teeth (Figs. 65, 66), and from all *Tetragnatha* species by the doubled-up, U-shaped posterior lateral seminal receptacles (Fig. 69). Both margins of the silver streak on sides of the abdomen are wavy (Fig. 65).

Natural History. Specimens have been collected from white spruce in Northwest Territories; trees in New Brunswick; shrubs, tall grasses in a swamp, sweeping grass and forest, and a cottage in Ontario.

Distribution. Northern Eurasia, Alaska to northern states (Map 2). The southernmost localities are Trenton Falls, New York; Point Comfort, Winnebago Co., Wisconsin; Saint Peters, Nicollet Co., Minnesota; and near Forked Lake, Eagletown, McCurtain Co., Oklahoma, ♂ without date (Map 2).

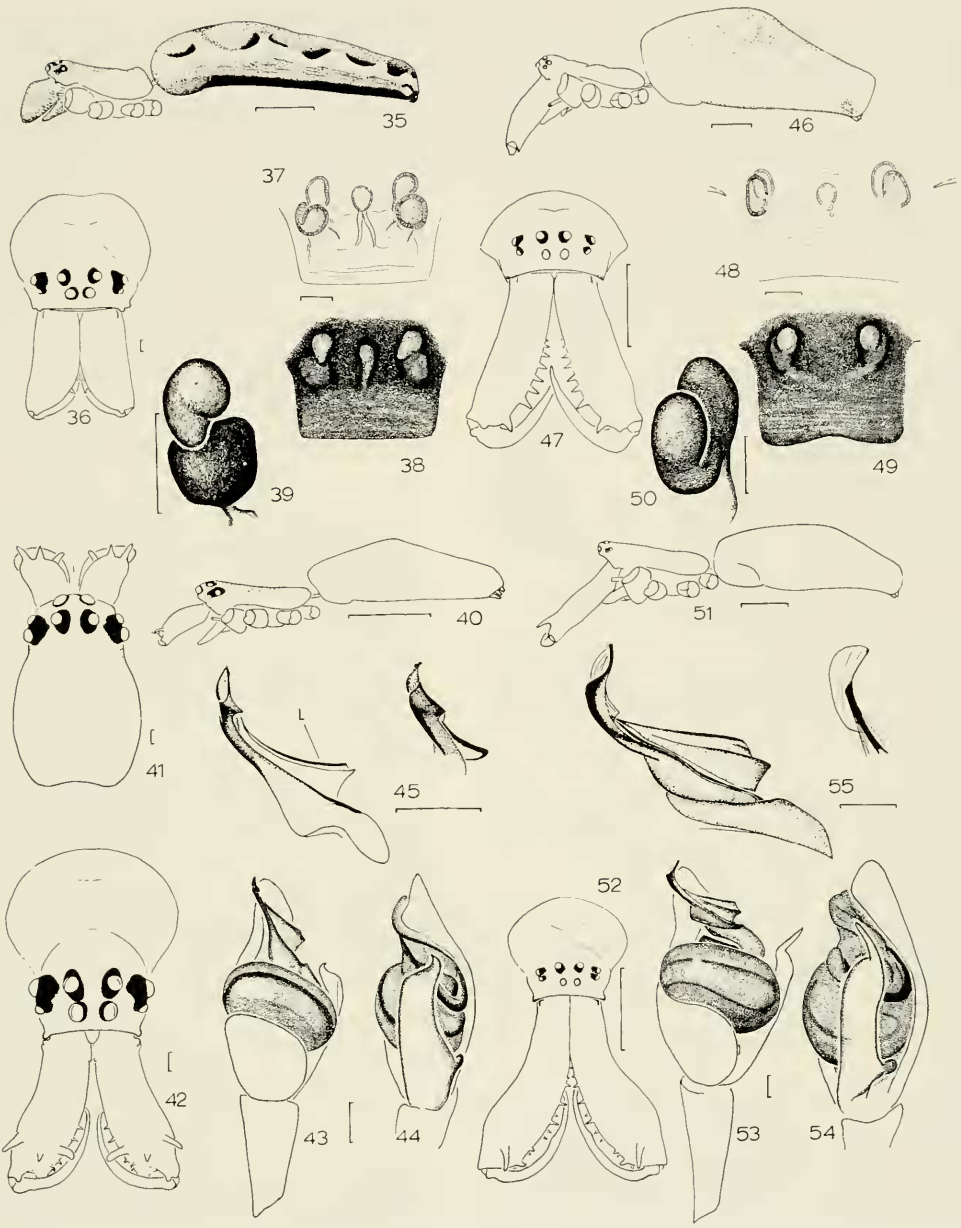
Tetragnatha elongata Walckenaer
Plates 5g–i; Figures 74–89; Map 3

Tetragnatha elongata Walckenaer, 1805, Tableau des Aranéides, p. 69. Name for Bosc manuscript fig. 5, ♀, "*Aranea gibba*" from the Carolinas. Photocopy in the Museum of Comparative Zoology, examined. Male neotype from Raleigh, North Carolina in garden, 21 to 31 August 1944 (C. S. Brimley) in the Museum of Comparative Zoology, here designated. Seeley, 1928, Bull. New York State Mus., 278: 109, pl. 1, figs. 11–13, pl. 2, figs. 14–16, ♀, ♂. Comstock, 1940, Spider Book, rev. ed., p. 425, figs. 424, 425, ♀, ♂. Roewer, 1942, Katalog der Araneae, 1: 992. Kaston, 1948, Bull. Connecticut Geol. Natur. Hist. Surv., 70: 270, figs. 853, 854, 865, 867, ♀, ♂. Bonnet, 1959, Bibliographia Araneorum, 2: 4322. Chickering, 1959, Bull. Mus. Comp. Zool., 119: 480, figs. 9–12, ♀, ♂.

Tetragnatha grallator Hentz, 1850, J. Boston Soc. Natur. Hist., 6: 26, pl. 4, figs. 1, 2, ♀, ♂. Syntypes from Pennsylvania, North and South Carolina, Alabama, destroyed.

Variation. Total length of females, 8.2 to 13.2 mm; of males, 4.8 to 10.5 mm. The smallest individuals are from the northern states, the largest from Texas. The tibia of the palpus is usually longer than the cymbium, occasionally shorter. Chelicerae from large and small specimens are illustrated by Figures 83–89.

Diagnosis. This species has the lateral eyes closer together than the medians, and both sexes have long chelicerae (Figs. 74, 75, 79, 80).



Figures 35–45. *Tetragnatha earmra* n. sp. 35–39. Female. 35. Lateral. 36. Chelicerae and eye region. 37–39. Genital area. 37. Dorsal. 38. Ventral, cleared. 39. Left seminal receptacles, ventral. 40–45. Male. 40. Lateral. 41. Carapace and chelicerae. 42. Chelicerae and eye region. 43–45. Left palpus. 43. Ventral. 44. Lateral. 45. Conductor, ventral, and conductor tip, mesal.

Figures 46–55. *Tetragnatha guatemalensis* O. P.-Cambridge. 46–50. Female. 46. Lateral. 47. Chelicerae and eye region. 48–50. Genital area. 48. Dorsal view. 49. Ventral, cleared. 50. Left seminal receptacles, ventral. 51–55. Male. 51. Lateral. 52. Chelicerae and eye region. 53–55. Palpus. 53. Ventral. 54. Lateral. 55. Conductor, ventral, and tip of conductor, mesal.

Scale lines. 0.1 mm; except Figs. 35, 40, 46, 47, 51, 52, 1.0 mm.

Abbreviations. L, pleats of conductor (Fig. 45).

The male is easily recognized by the conductor, which tapers evenly to its tip (Fig. 82) and terminates in a minute hook (Plate 5i). The distal third of the conductor is convex laterally, especially noticeable when viewed from slightly ventrolaterally. The tip bends toward the cymbium. There are usually three, sometimes two, pleats, and the base of the conductor has a transparent shield (Figs. 82, 88, 89). The conductor tip (Plate 5g) is much smaller than that of *T. straminea*. The palpus in ventral view can be confused with that of *T. dearmata*, but it lacks the dorsal extension of the tip. Unlike *Tetragnatha versicolor*, the male chelicerae are almost always longer than the carapace (Figs. 79, 84–87), and the recurved hook at the tip of the conductor is minute (Plate 5g–i; Fig. 82).

The female can readily be separated from other species: the chelicerae usually are at least equal to or greater than carapace length, usually with a lateral cusp outside near base of fang (Figs. 74, 75, 83). Unlike all other North American species, the median of each pair of seminal receptacles is longer than twice the width, and placed paraxial in the abdomen, parallel to each other (Figs. 76–78).

Natural History. The large, nearly horizontal (sometimes vertical) webs are placed over small streams or other running water, often in woods or shaded branches. The web has 4 to 5 turns outside of the hub, a free space, and 30 to 40 spirals.

Distribution. Eastern North American from New Brunswick, Quebec, Manitoba south to Cuba, Jamaica, central Mexico. Uncommon in Western states. Western records are: Salmon Arm and Wellington, British Columbia; northeast of Fruitland and Notus, Idaho; in Washington, Silver Lake, Cowlitz Co., Chase Lake, King Co., and Seattle; Eugene, Philomath, and Corvallis, Oregon; Monterey, California; and Sierra Laguna, Baja California (Map 3).

Tetragnatha versicolor Walckenaer
Plates 3, 6a–f; Figures 90–109; Map 3

Tetragnatha versicolor Walckenaer, 1841, Histoire Naturelle des Insectes Aptères, 2:215. Name given to Abbott's illustration of Georgian spiders, p. 20, fig. 231, ♀ and p. 37, fig. 466, ♀. Photocopy in the Museum of Comparative Zoology, examined. Male neotype from Bar-M Ranch, south of Boston, Thomas Co., Georgia, 4 April 1973 (W. T. Sedgwick) in the Museum of Comparative Zoology here designated. Kaston, 1948, Bull. Connecticut Geol. Natur. Hist. Surv., 70: 270, figs. 852, 862–864, ♀, ♂. Chickering, 1959, Bull. Mus. Comp. Zool., 119: 497, figs. 53–57, ♀, ♂.

Tetragnatha convexa Banks, 1898, Proc. California Acad. Sci., ser. 3, 1: 247. "Several specimens from San José del Cabo" Baja California in the California Academy of Sciences, destroyed in the California earthquake of 1906.

Tetragnatha extensa:—Seeley, 1928, Bull. New York State Mus., 278: 113, figs. 17–20, ♀, ♂. Comstock, 1940, Spider Book, rev. ed., p. 425. Bonnet, 1959, Bibliographia Araneorum, 2: 4323 (in part only). Not *T. extensa* Linnaeus.

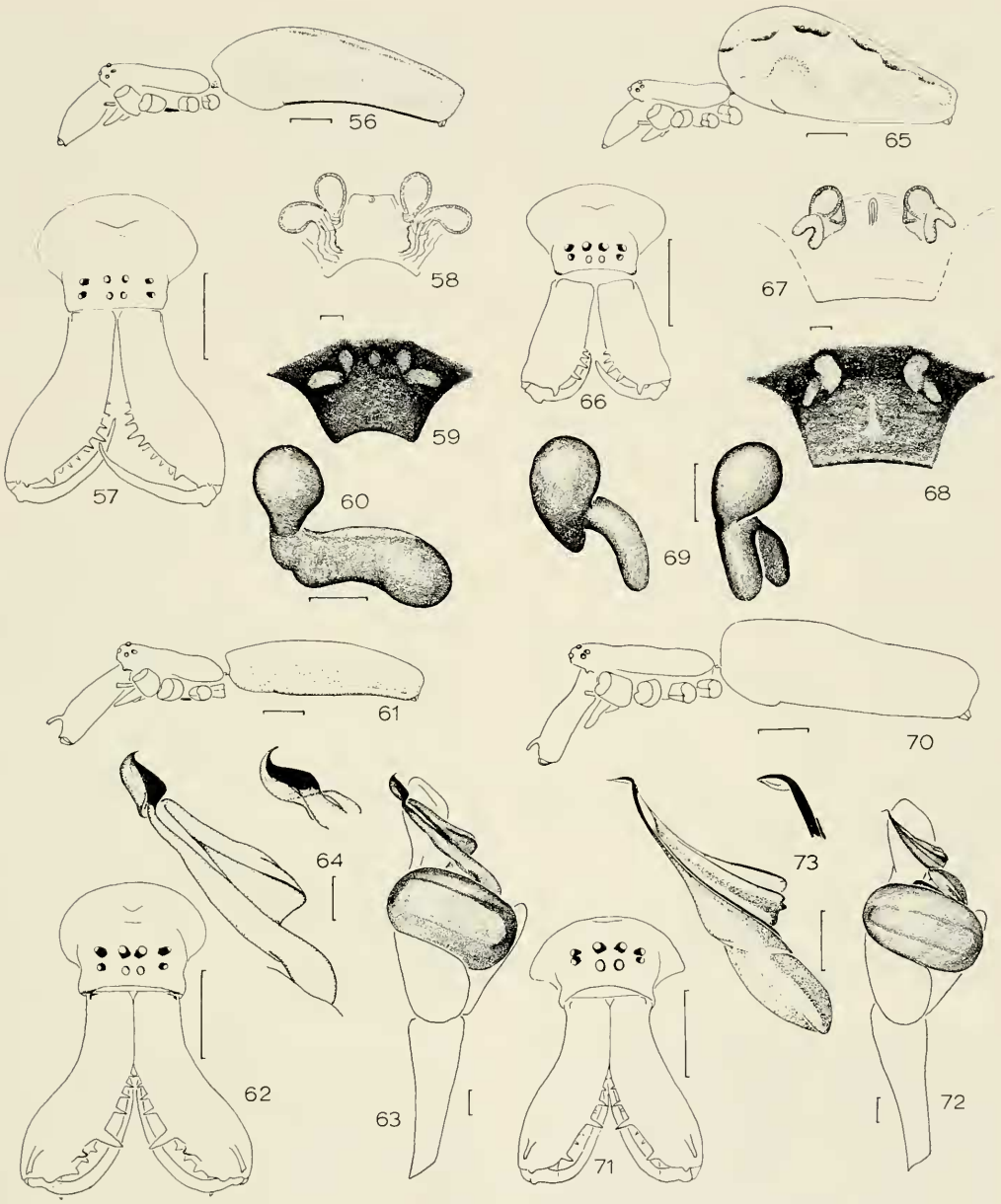
Tetragnatha limnocharis Seeley, 1928, Bull. New York State Mus., 278: 129, figs. 32–35, ♀, ♂. Male lectotype here designated from Nixon's Hammock, Okefenokee Swamp, Georgia in the American Museum of Natural History, examined. NEW SYNONYMY.

Tetragnatha munda Chamberlin and Gertsch, 1929, J. Ent. Zool., 21: 103, pl. 4, figs. 41–45, ♀, ♂. Male holotype from Clear Lake, California, in the American Museum of Natural History, examined. NEW SYNONYMY.

Tetragnatha marianna Archer, 1940, Paper Alabama Mus. Natur. Hist., 14: 20, pl. 1, fig. 1, ♂. Male holotype from Randon's Creek, Monroe Co., Alabama in the American Museum of Natural History, examined. NEW SYNONYMY.

Note. The Museum of Comparative Zoology collection has one male of *T. convexa* from Sierra Laguna, Baja California, N. Banks collection; the labels are in A.M. Chickering's handwriting. I am uncertain if this is a syntype of *T. convexa*.

Variation. This is a variable species. The abdominal patterns vary from completely silver to contrasting paired dorsal markings (Fig. 90). The base of the conductor of the palpus has at times a distinct transverse fold in the middle (Figs. 98, 104), but often this break is not visible. The tip of the conductor in western and northern specimens is sclerotized and



Figures 56–64. *Tetragnatha extensa* (Linnaeus). 56–60. Female. 56. Lateral. 57. Chelicerae and eye region. 58–60. Genital area. 58. Dorsal. 59. Ventral, cleared. 60. Left seminal receptacle, ventral. 61–64. Male. 61. Lateral. 62. Chelicerae and eye region. 63, 64. Left palpus. 63. Ventral. 64. Conductor, ventral, and tip, mesal.

Figures 65–73. *Tetragnatha dearmata* Thorell. 65–69. Female. 65. Lateral. 66. Chelicerae and eye region. 67–69. Genital area. 67. Dorsal. 68. Ventral, cleared. 69. Left seminal receptacles, ventrolateral and lateral. 70–73. Male. 70. Lateral. 71. Chelicerae and eye region. 72, 73. Palpus. 72. Ventral. 73. Conductor, ventral, and tip, mesal.

Scale lines. 0.1 mm; except Figs. 56, 57, 61, 62, 65, 66, 70, 71, 1.0 mm.

dark (Fig. 98); in southeastern specimens it is usually white (Figs. 104–109). Those with light tips for a while were considered a separate species since there were also differences in shape. But in examining a light-tipped specimen and a dark-tipped one collected together from Ontario, and a few dark-tipped ones from the South, I found that the differences were in degree of sclerotization; there are no consistent differences in shape (Plates 6a–f).

The tibia of the palpus is often longer than the cymbium in southeastern specimens; others from the same area have the tibia shorter than the cymbium.

One collection from Centreville, Wilkinson County, Mississippi, January to July 1944 (A. F. Archer) has the lateral eyes separated by the same distance as the medians.

Total length of females, 5.4 to 13.3 mm; total length of males, 4.3 to 9.2 mm. The largest specimens are from California, some of the smallest from the Everglades region in Florida.

The neotype and the original specimens illustrated by Abbot come from Georgia, where males have a lightly sclerotized conductor tip.

Diagnosis. This species has the lateral eyes closer to each other than the medians (Figs. 91, 96), and some dusky markings on cephalothorax and abdomen (Fig. 90).

The male can be separated from other species by the recurved tip of the conductor, pointing proximally; there is a slight swelling at the base of the tip (Plate 6a–f; Fig. 98). The male can be separated from *T. elongata* by the chelicerae, usually shorter than the carapace length (Figs. 95, 96). Males have been confused with *T. viridis*. *Tetragnatha versicolor* is never green, as is *T. viridis*; the lateral eyes in *T. versicolor* are closer together than the medians, in *T. viridis* as far apart as the medians.

The female has two seminal receptacles on each side, separated; the members of each pair are less than their diameter apart (Figs. 92–94). The placement and shape are different from those of other *Tetragnatha* species with lateral eyes closer together than medians.

Natural History. Specimens have been collected from mixed coniferous forests; spruce forests; flood plain forests, deciduous trees; grasses along edges of fields, always near water; and various species of trees and shrubs, including aspens in Wyoming, oranges in Florida, and sweeping sagebrush (*Artemia* sp.) in Colorado.

Distribution. Alaska to Nicaragua and Cuba (Map 3).

Tetragnatha viridis Walckenaer
Plates 3, 6g; Figures 110–119; Map 3

Tetragnatha viridis Walckenaer, 1841, Histoire Naturelle des Insectes Aptères, 2:216. Name given to fig. 236, ♀, p. 20 and fig. 471, ♀, p. 37 of Abott's manuscript of Georgian spiders. Photocopies in the Museum of Comparative Zoology, examined. Male neotype from Brier Creek, 7 mi. north of Sylvania, Screven County, Georgia, 12 April 1943 (W. Ivie) in the American Museum of Natural History, here designated. Kaston, 1948, Bull. Connecticut Geol. Natur. Hist. Surv., 70: 272.

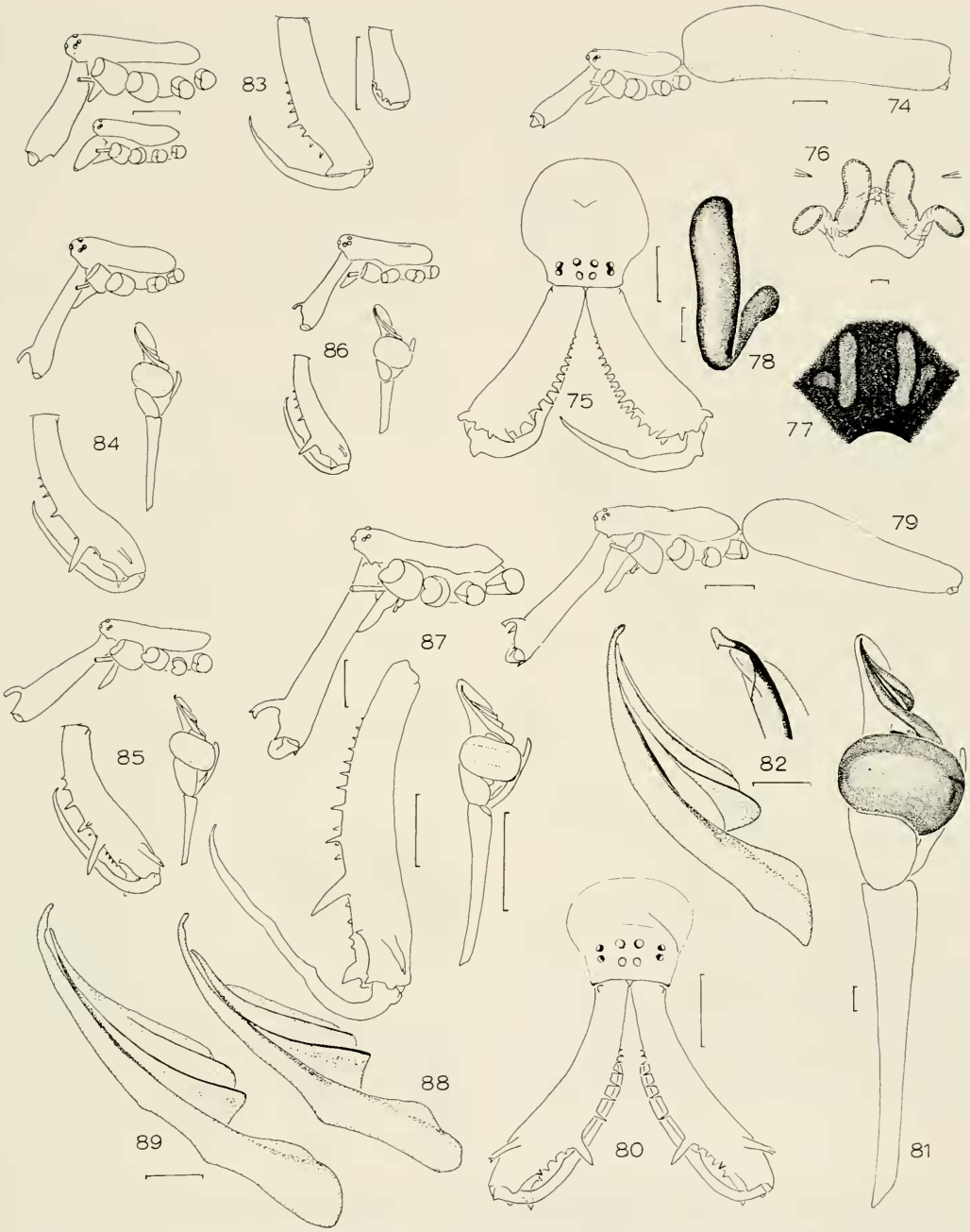
Tetragnatha pinicola Emerton, 1915, Trans. Connecticut Acad. Sci., 20: 139, figs. 7a, b, ♀, ♂. One male, four female syntypes from Nantucket, Massachusetts, in the Museum of Comparative Zoology, examined. Not *T. pinicola* L. Koch, 1870.

Tetragnatha pinea Seeley, 1928, Bull. New York State Mus., 278: 133, figs. 21–24, ♀, ♂. New name for *T. pinicola* Emerton preoccupied by L. Koch. Bonnet, 1959, Bibliographia Araneorum, 2: 4351.

Note. Chickering determined *T. viridis* specimens in collections as *T. versicolor*.

Variation. Some specimens are all green, some are partly reddish. A green juvenile from Massachusetts turned into an adult male after two molts (in a vial), with carapace greenish on sides; sternum reddish; legs light brown with red spots; dorsum of abdomen with a wide longitudinal red band having parallel white sides; sides of abdomen dark green; venter silvery.

The green and red color fade rapidly in alcohol preserving fluid. Total length of



Figures 74–89. *Tetragnatha elongata* Walckenaer. 74–78. Female. 74. Lateral. 75. Chelicerae and eye region. 76–78. Genital area. 76. Dorsal. 77. Ventral, cleared. 78. Left seminal receptacles, ventral. 79–82, Male. 79. Lateral. 80. Chelicerae and eye region. 81, 82. Left palpus. 82. Conductor and embolus, ventral, and conductor tip, mesal. 83–89. *Variation.* 83. Carapace and left chelicera of two adult females collected together (Massachusetts). 84–87. Male carapace, left chelicera and left palpus. 84. (Massachusetts). 85. (Wisconsin). 86. (Washington state). 87. (Texas). 88, 89. Conductor, ventral. 88. (Wisconsin). 89. (Texas).

Scale lines. 0.1 mm; except Figs. 74, 75, 79, 80, 83–87, 1.0 mm.

females, 5.7 to 7.4 mm; total length of males, 4.4 to 6.7 mm.

Diagnosis. Faded, preserved specimens look like *T. laboriosa* but have genitalia like those of *T. versicolor*. The lateral eyes are about as far apart as the medians (Figs. 111, 117).

Specimens can be distinguished from *T. laboriosa* by the green or reddish color; in males by the similarity of the palpal conductor tip to that of *T. versicolor* (Plate 6g; Fig. 119); and in females by the seminal receptacles (Fig. 114).

This species can easily be distinguished from *T. versicolor*, which has similar genitalia, by the separated lateral eyes (Figs. 111, 117). These are farther apart than the medians in the male, as far apart as the medians in the female. Other distinguishing features are the green to red coloration, and the abdominal markings: bands with straight margins (Fig. 110) rather than the lobed gray markings on the dorsum of *T. versicolor*. *T. viridis* also differs from *T. laboriosa* and *T. versicolor* by the long macrosetae on the legs; those of the first tibia have a length 5 to 8 times the diameter of the tibia (Fig. 115).

The green coloration and long leg macrosetae make it possible to determine juveniles.

The only differences that could be found in the conductors of *T. viridis* and *T. versicolor* are in the pleats near the base at the lateral end: in *T. viridis* they look as though lifted up (Fig. 119).

Natural History. This species lives in pines, occasionally in other conifers, and is difficult to find since it rests appressed to the needles. It is also difficult to dislodge by sweeping or beating. In Massachusetts the species is common in pitch pine (*Pinus rigida*) in sandy areas of Cape Cod. In Massachusetts adults can be found from late May to early July. Juveniles are found later in the season, and they overwinter. This short season is unusual for *Tetragnatha*.

Distribution. New Brunswick to North Carolina along coastal pine forest, southeastern states to northern Florida, eastern Texas (Map 3).

Records. New Brunswick. Fredericton, 6–9 July 1970, ♀ in balsam fir (T. R. Renault). *Massachusetts.* Barnstable Co.: Chatham, South Chatham, Harwich, between Falmouth and Bourne, many specimens. Essex Co.: Essex 24 June 1878, pine trees, ♀, ♂ (J. H. Emerton). *Connecticut.* New Haven Co.: Mt. Carmel, 12 Sept. 1936, juv. (B. J. Kaston). *New Jersey.* Ocean Co.: Lakehurst, 13 May 1909, ♀, ♂. *North Carolina.* Pasquotank Co.: Elizabeth City, May 1900, ♂ (J. H. Emerton). *Georgia.* Thomas Co.: Bar-M Ranch, 28 April 1973, ♀ (G. B. Edwards). *Florida.* Jackson Co.: 30 mi. southeast of Marianna, 1 May 1933, ♀ (H. K. Wallace). Jefferson Co.: Monticello, 11 April 1968, ♀ (A. M. Chickering). Liberty Co.: Rock Bluff, 4 April 1927, ♂ (C. R. Crosby). *Alabama.* Lee Co.: Chewacla Creek State Park, April 1947, ♂ (A. F. Archer). Tuscaloosa Co.: Tuscaloosa, 13 April 1941, ♂ (A. F. Archer). *Arkansas.* Calhoun Co.: 5 Nov. 1964, juv. on pine (L. O. Warren). *Texas.* Harris Co.: 9 mi. west of Tomball, 5 Dec. 1968, juv. in freshly felled pine (E. Sabath).

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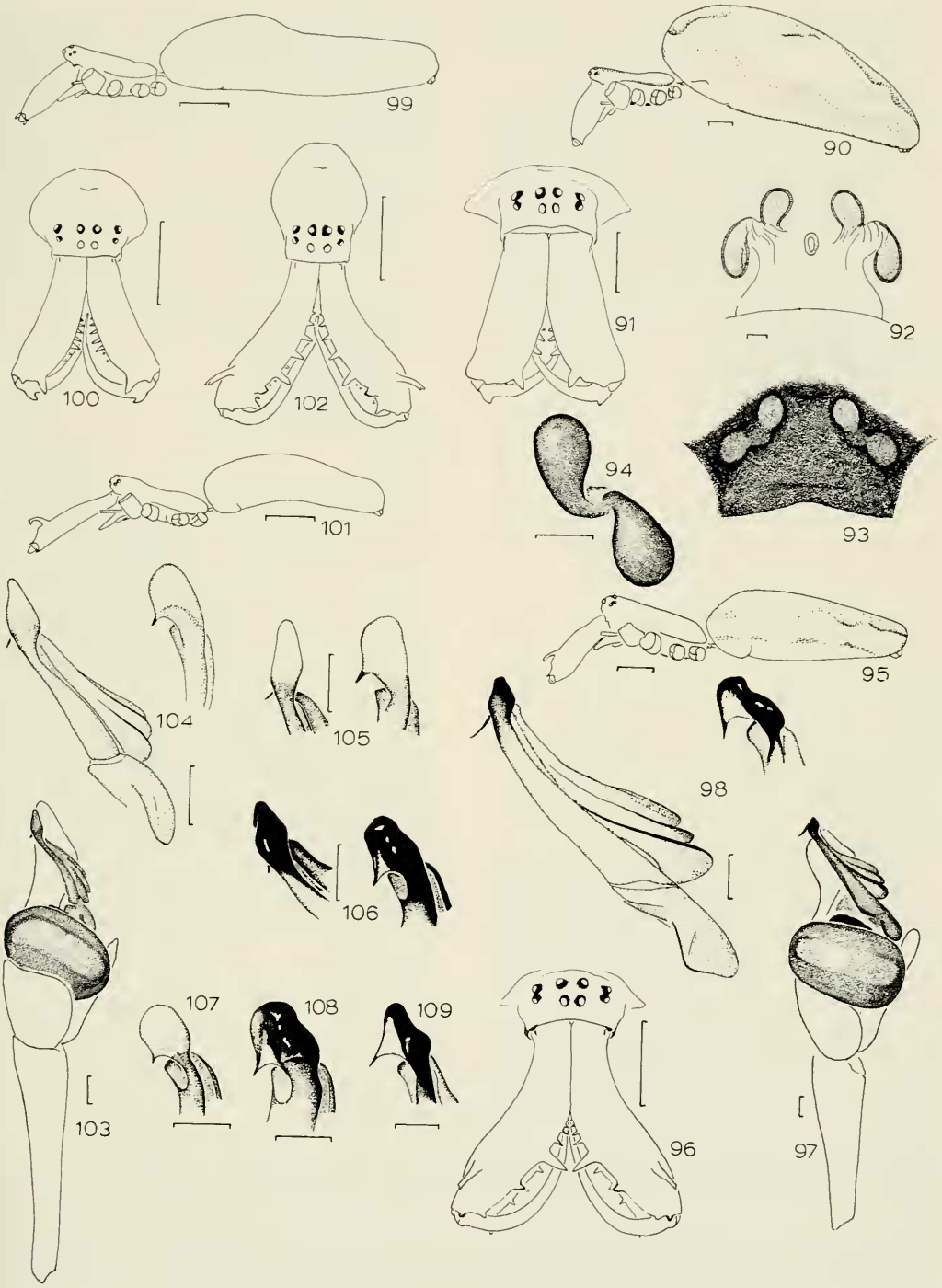
Figures 90–109. *Tetragnatha versicolor* Walckenaer. 90–94. Female (California except 94, Michigan). 90. Lateral. 91. Chelicerae and eye region. 92–94. Genital area. 92. Dorsal. 93, Ventral, cleared. 94. Left seminal receptacles, ventral. 95–98. Male (California). 95. Lateral. 96. Chelicerae and eye region. 97, 98. Left palpus. 97. Ventral. 98. Conductor, ventral, and tip, mesal. 99–109. *Variation.* 99, 100. Female (Florida). 99. Lateral. 100. Chelicerae and eye region. 101, 102. Male (Georgia). 101. Lateral. 102. Chelicerae and eye region. 103, 104. Palpus (Georgia). 103. Ventral. 104. Conductor, ventral, and tip, mesal. 105, 106. Conductor tips, ventral and mesal (both Oxford Mills, Ontario). 107–109. Conductor tips, mesal. 107. (New Brunswick). 108. (Neel Gap, Georgia). 109. (California).

Scale lines. 0.1 mm; except Figs. 90, 91, 95, 96, 99–102, 1.0 mm.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Tetragnatha laboriosa Hentz

Plate 6h, i; Figures 16–22, 120–128; Map 3

Tetragnatha laboriosa Hentz, 1850, J. Boston Soc. Natur. Hist., 6: 27, pl. 4, fig. 3, ♂. Specimens from United States, destroyed. Male neotype from Holliston, Massachusetts, 23 June 1929 (N. Banks) in the Museum of Comparative Zoology here designated. Seeley, 1928, Bull. New York State Mus., 278: 123, figs. 25–31, ♀, ♂. Comstock, 1940, Spider Book, rev. ed., p. 426. Roewer, 1942, Katalog der Araneae, 1: 992. Kaston, 1948, Bull. Connecticut Geol. Natur. Hist. Surv., 70: 269, figs. 850–851, 859–861, ♀, ♂. Chickering, 1959, Bull. Mus. Comp. Zool., 119: 486, figs. 26–30, ♀, ♂. Bonnet, 1959, Bibliographia Araneorum, 2: 4335.

Tetragnatha illinoiensis Keyserling, 1879, Verhandl. Zool. Bot. Gesell. Wien, 29: 318, pl. 4, fig. 18, ♀. Female from Illinois in the British Museum, Natural History, examined.

Tetragnatha numa Levi, 1955, Canadian Field Natur., 69: 37, figs. 19–23, ♀, ♂. Male holotype from Bowman Lake, Glacier National Park, Montana in the American Museum of Natural History, examined. NEW SYNONYMY.

Variation. The lateral eyes are usually as far apart as the medians, sometimes slightly closer together or very slightly farther apart. Occasionally there is a dark folium on the dorsum of the abdomen; the folium is usually more distinct posteriorly than anteriorly. Total length of females, 5.2 to 9.0 mm; total length of males, 3.8 to 7.4 mm.

Diagnosis. The lateral eyes are almost as far apart or as separate as the medians (Figs. 121, 126). Similar eye distances are also found in *T. extensa*, *T. shoshone*, and the green *T. viridis*. There is very little gray pigment on the body.

The male differs from other species by the bird head-shaped tip of the conductor (Plate 6i; Fig. 128); the tip is often slightly turned to point dorsally to the cymbium. The conductor is twisted near midway, and there are about two pleats, the proximal pleat lifted up away from the conductor (Plate 6h; Figs. 127, 128).

The female can only be separated from similar species by the seminal receptacles. Each pair has a large pouch between the anterior and posterior receptacles which partly hides the anterior receptacle in ventral view (Fig. 124). This is unlike that of any other species.

Natural History. Specimens have been found in grass, often dry fields some distance from water; in soybean fields in North Carolina; in cotton, sweet potato, and alfalfa fields in Arkansas; in tomatoes in California; in pasture in Texas; in high meadows to 3000 m elevation in Colorado; and in bog in New Brunswick. It has rarely been found in trees.

Distribution. Alaska to Panama (Map 3).

Tetragnatha pallescens F. P.-Cambridge

Plates 4, 7a; Figures 129–139; Map 4

Eugnatha pallida Banks, 1892, Proc. Acad. Natur. Sci. Philadelphia, p. 51, fig. 88, ♂. Two male and one female syntypes from Ithaca, New York in the Museum of Comparative Zoology, examined. Not *T. pallida* O. P.-Cambridge, 1889.

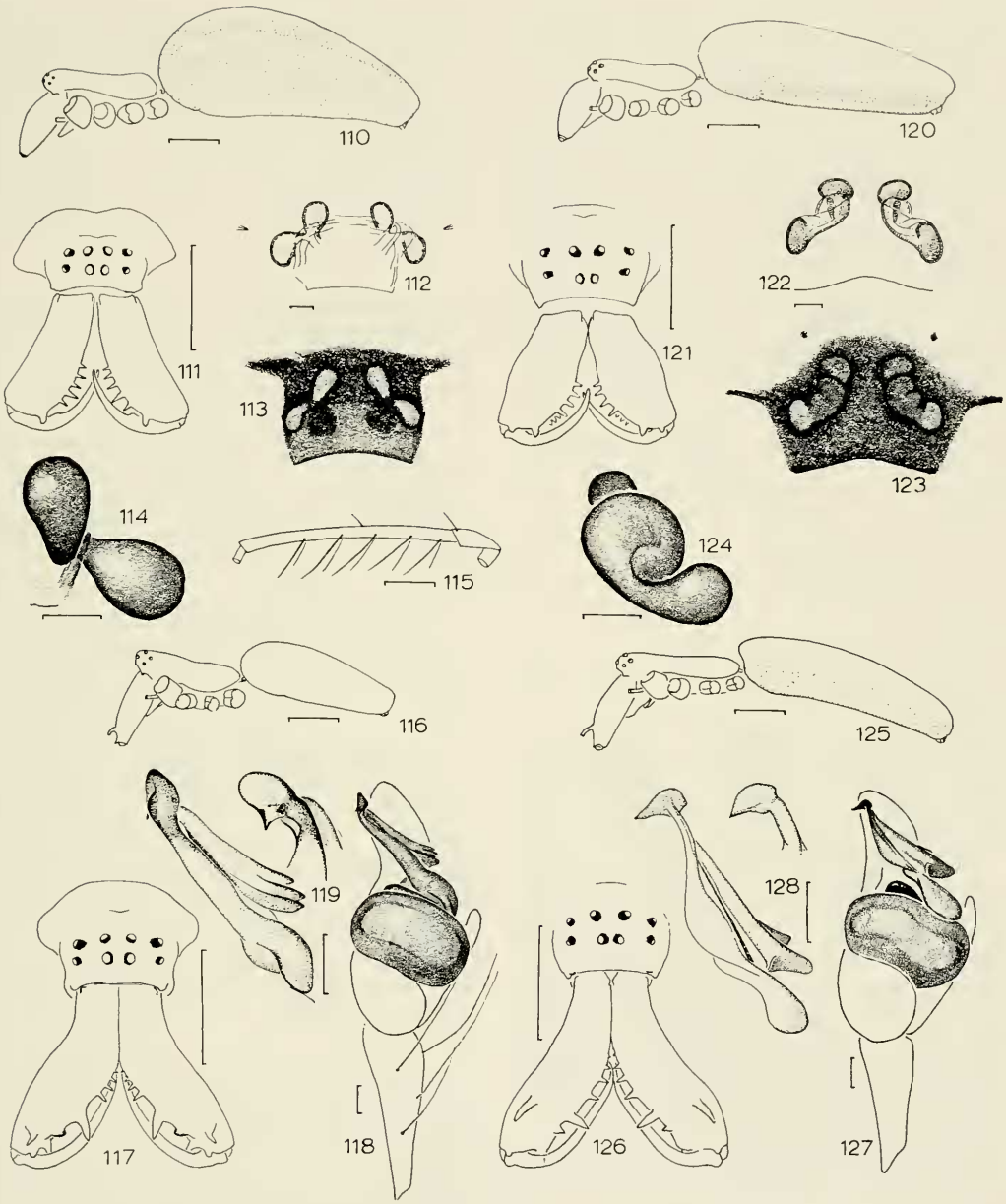
Tetragnatha pallescens F. P.-Cambridge, 1903, Biologia Centrali-Americana, Araneidea, 2: 436. New name for *T. pallida* Banks preoccupied by *T. pallida* O. P.-Cambridge. Seeley, 1928, Bull. New York State Mus., 278: 131, pl. 3, figs. 40–43, ♀, ♂. Comstock, 1940, Spider Book, rev. ed., p. 429. Roewer, 1942, Katalog der Araneae, 1:992. Kaston, 1948, Bull. Connecticut Geol. Natur. Hist. Surv., 70: 272, figs. 875–876, ♀, ♂. Chickering, 1959, Bull. Mus. Comp. Zool., 119:487, figs. 31–35, ♀, ♂. Bonnet, 1959, Bibliographia Araneorum, 2: 4350.

Eugnatha pallidula Banks, 1910, Bull. U.S. Natl. Mus., 72, p. 36. New name for *T. pallida* Banks, preoccupied by *T. pallida* O. P.-Cambridge.

Variation. Females may have either large or small chelicerae (Figs. 134, 135). Total length of females, 7.3 to 12.2 mm; males, 6.5 to 9.6 mm.

Diagnosis. The lateral eyes are farther apart than the medians (Figs. 130, 137). The abdomen is entirely covered with minute silvery spots, the spots least dense on the venter.

The male can be separated from other species having similar eye spacing by the conductor of the palpus: the lower surface of the proximal end is concave (Figs. 138, 139), and the tip has a bulge above



Figures 110–119. *Tetragnatha viridis* Emerton. 110–115. Female. 110. Lateral. 111. Chelicerae and eye region. 112–114. Genital area. 112. Dorsal. 113. Ventral, cleared. 114. Left seminal receptacles, ventral. 115. First left patella and tibia with macrosetae. 116–119. Male. 116. Lateral. 117. Chelicerae and eye region. 118, 119. Left palpus. 118. Ventral, 119, Conductor, ventral, and tip, mesal.

Figures 120–128. *Tetragnatha laboriosa* Hentz. 120–124. Female. 120. Lateral. 121. Chelicerae and eye region. 122–124. Genital area. 122. Dorsal. 123. Ventral, cleared. 124. Left seminal receptacles, ventral. 125–128. Male. 125. Lateral. 126. Chelicerae and eye region. 127, 128. Palpus. 127. Ventral. 128. Conductor with embolus, ventral, and conductor tip, mesal.

Scale lines. 0.1 mm; except Figs. 110, 111, 116, 117, 120, 121, 125, 126, 1.0 mm.

the neck (in ventral view) under the terminal hook (Plate 7a; Fig. 139). There is one pleat (Fig. 139).

The female is separated from *T. caudata*, *T. branda*, and *T. vermiformis* by the long, slender shape of the abdomen, lacking a tail (Fig. 129). Females are separated from *T. straminea* by the abdomen having silver sides (Fig. 129); there is no distinct line where the silver ends and the pigmentless area starts, but sometimes the dorsal silver grades into a less dense ventral silver area. Females can be confused with those of *T. laboriosa*, but *T. laboriosa* has some gray pigment on the sternum and venter of the abdomen, absent in *T. pallescens*. In the West Indies and Central America, where *T. straminea* does not occur, *Tetragnatha pallescens* may have a line on each side, above which there is silver and below which there are only scattered silver spots.

Females from the northern part of the range can be confused with those of *T. shoshone*. The seminal receptacles of each pair are more than their distance apart in *T. pallescens*, with the intermediate connection being a lobe (Fig. 133); in *T. shoshone* they are almost touching.

Natural History. Specimens have been collected from pine trees on Nantucket, Massachusetts, and sandflats and lake shore in Pennsylvania. In Florida the species has been found in parlor palm (*Chamaedorea erumpens*), mangroves, tall grasses, roadside weeds, vegetation along lakeshore and pond in waste fields. It has also been found in rice in Arkansas, and grasses in water in Texas.

Distribution. Southern Canada to Panama, West Indies (Map 4).

Tetragnatha caudata Emerton
Plate 7b, c; Figures 140–148; Map 4

Tetragnatha caudata Emerton, 1884, Trans. Connecticut Acad. Sci., 6: 335, pl. 39, figs. 16, 22, ♀. Penultimate instar female holotype in poor physical condition from Malden, Massachusetts in the Museum of Comparative Zoology, examined. Seeley, 1928, Bull. New York State Mus., 278: 107, figs. 5–10, ♀, ♂. Kaston, 1948, Bull. Connecticut Geol. Natur. Hist. Surv., 70: 273, figs. 873, 874, ♀. Chickering, 1959, Bull. Mus. Comp. Zool., 119: 479, figs. 1–8, ♀, ♂.

Tetragnatha lacerta:—Comstock, 1940, Spider Book, rev. ed., p. 429, fig. 428, ♀. Roewer, 1942, Katalog der Araneae, 1: 993.

Eucta lacerta:—Bonnet, 1956, Bibliographia Araneorum, 2: 1807.

Note. This species has often been referred to as *T. lacerta* Walckenaer. *Tetragnatha lacerta* is a doubtful name and has also been used for *Argyrodes fictilium* (Hentz), Theridiidae.

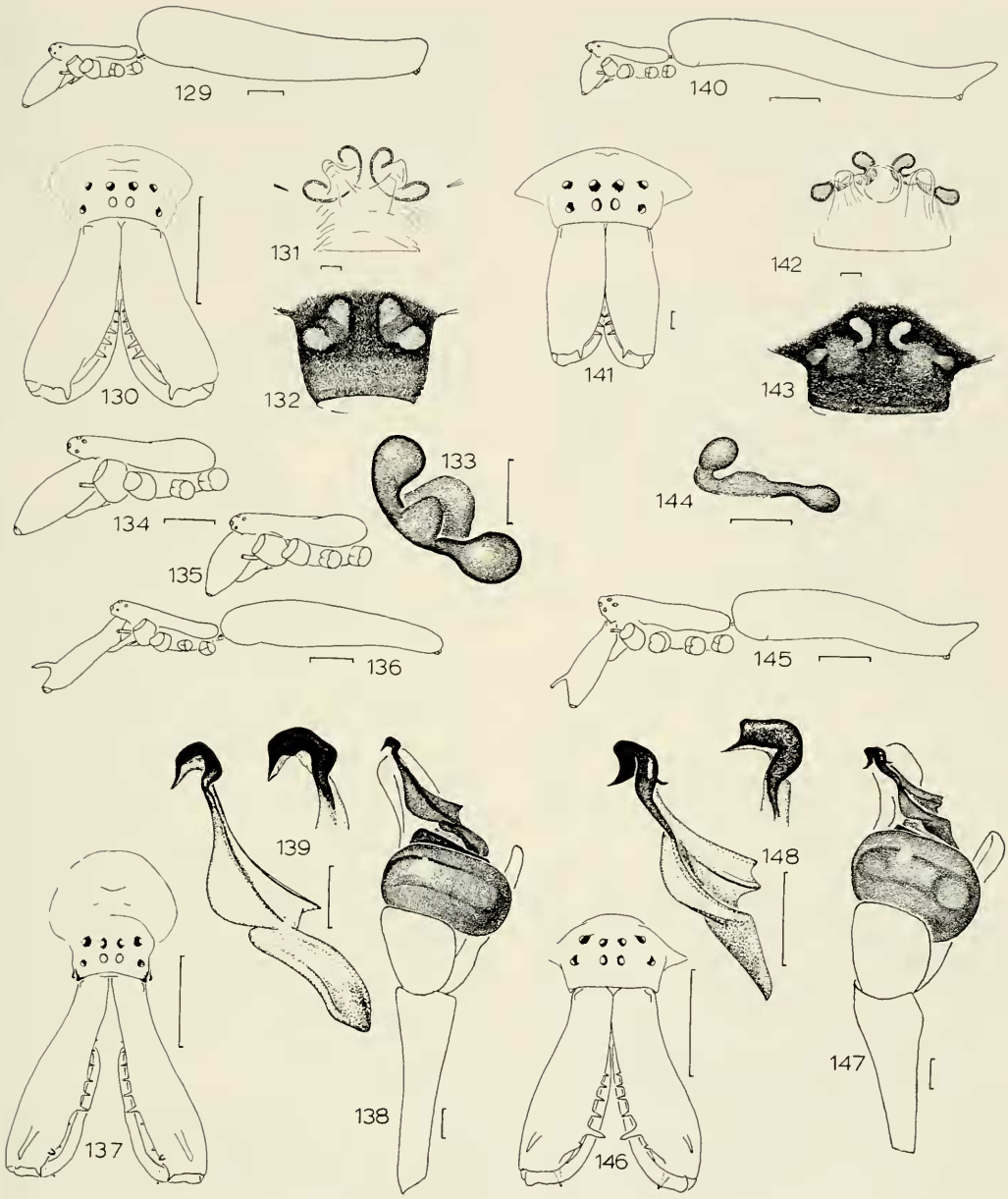
Variation. Tail length is quite variable, often very much longer than illustrated. Total length of females, 7.6 to 11.5 mm; of males, 5.7 to 8.9 mm. The lateral eyes are farther apart than the medians (Figs. 141–146).

Diagnosis. Both sexes are readily separated from other *Tetragnatha* species (except *T. branda*) by the presence of a tail behind the spinnerets (Figs. 140–145).

Tetragnatha caudata males have pleats on their conductor, and a hook on the tip of the conductor (Plate 7b, c; Fig. 148), both lacking in *T. branda*. In males the proximal end of the conductor is twisted below the pleats (Fig. 148); the distal hook faces mesally and points dorsally (Plate 7b; Fig. 148). At the base of the hook is a small spur seen in ventral view, absent in other species (Plate 7c; Fig. 147).

In females the seminal receptacles are relatively small, the anterior medians of each pair closer together than to the other member of the pair (Figs. 142–144). Those of *T. branda* are close to each other on each side. The abdomen is entirely silver; on the dorsum the silver spots are fused, whereas they are less dense in a longitudinal line on the venter.

Natural History. Specimens have been collected from bogs; marshes; weeds along canal; swamp grass; lakeshores;



Figures 129–139. *Tetragnatha pallescens* F. P.-Cambridge. 129–135. Female. 129. Lateral. 130. Chelicerae and eye region. 131–133. Genital area. 131. Dorsal. 132. Ventral, cleared. 133. Left seminal receptacles, ventral. 134, 135. Carapace and chelicera of mature females (Tamiami Trail, Dade Co., Florida). 136–139. Male. 136. Lateral. 137. Chelicerae and eye region. 138, 139. Left palpus. 138. Ventral. 139. Conductor, ventral, and tip, mesal.

Figures 140–148. *Tetragnatha caudata* Emerton. 140–144. Female. 140. Lateral. 141. Chelicerae and eye region. 142–144. Genital area. 142. Dorsal. 143. Ventral, cleared. 144. Left seminal receptacles, ventral. 145–148. Male. 145. Lateral. 146. Chelicerae and eye region. 147, 148, Palpus. 147. Ventral. 148. Conductor, ventral, and tip, mesal.

Scale lines. 0.1 mm; except Figs. 129, 130, 134–137, 140, 141, 145, 146, 1.0 mm.

and ponds. In the Everglades the species has been found in tall grass.

Distribution. From Great Slave Lake to Panama, Cuba; absent from southwestern United States (Map 4). The northernmost locality are juvenile specimens from 5 mi. SE of Fort Providence, 15 Aug. 1965 (J. and W. Ivie, AMNH).

Tetragnatha straminea Emerton
Plates 4, 7d; Figures 149–157; Map 4

Tetragnatha straminea Emerton, 1884, Trans. Connecticut Acad. Sci., 6: 335, pl. 39, figs. 15, 17, 20, 21, ♀, ♂. One male and two female syntypes from New Haven, Connecticut in the Museum of Comparative Zoology, examined. Seeley, 1928, Bull. New York State Mus., 278: 136, figs. 49–54, ♀, ♂. Roewer, 1942, Katalog der Araneae, 1: 994. Comstock, 1940, Spider Book, rev. ed., p. 428, fig. 427, ♀. Kaston, 1948, Bull. Connecticut Geol. Natur. Hist. Surv., 70: 271, figs. 855–856, 868–871, ♀, ♂. Chickering, 1959, Bull. Mus. Comp. Zool., 119: 494, figs. 41–46, ♀, ♂. Bonnet, 1959, Bibliographia Araneorum, 2: 4356.

Variation. Total length of females, 7.1 to 12.7 mm; total length of males, 5.7 to 10.1 mm.

Diagnosis. The lateral eyes are much farther apart than the medians. Only the dorsum of the abdomen is silver (Figs. 149, 150, 154, 155).

The male of *T. straminea* can be separated from the other four species having similar eye placement by the paddle-shaped tip of the conductor (Fig. 157). The conductor has a narrow neck just below the tip (Plate 7d; Figs. 156, 157), unlike that of the similar *T. shoshone.*

The females can be separated from *T. caudata, T. branda, T. vermiformis, T. shoshone,* and *T. pallescens* by several features of the abdomen. Unlike *T. caudata,* the long abdomen of *T. straminea* lacks a tail. Unlike *T. caudata, T. shoshone, T. vermiformis,* and *T. pallescens,* the upper, silvery half of each side is clearly delineated from the ventral half by a straight line. Also, the seminal receptacles are more variable in position than those of other species. Although they might be confused with those of *T. pallescens,* in *T. straminea* these structures are about their length apart (Fig. 153), nor is the connection swollen.

Natural History. Specimens have been collected from sweeping ferns and bogs in Ontario; sweeping honeysuckle (*Lonicera* sp.) in West Virginia; cedar bogs in Ohio; rocky gorges in New York; and bottomland forests and swamp foliage in Florida.

Distribution. Northern Alberta, Ontario, Utah, Florida, Cuba (Map 4). The northernmost collection came from Fort Murray, Alberta, July 1953, ♂ (G. E. Ball).

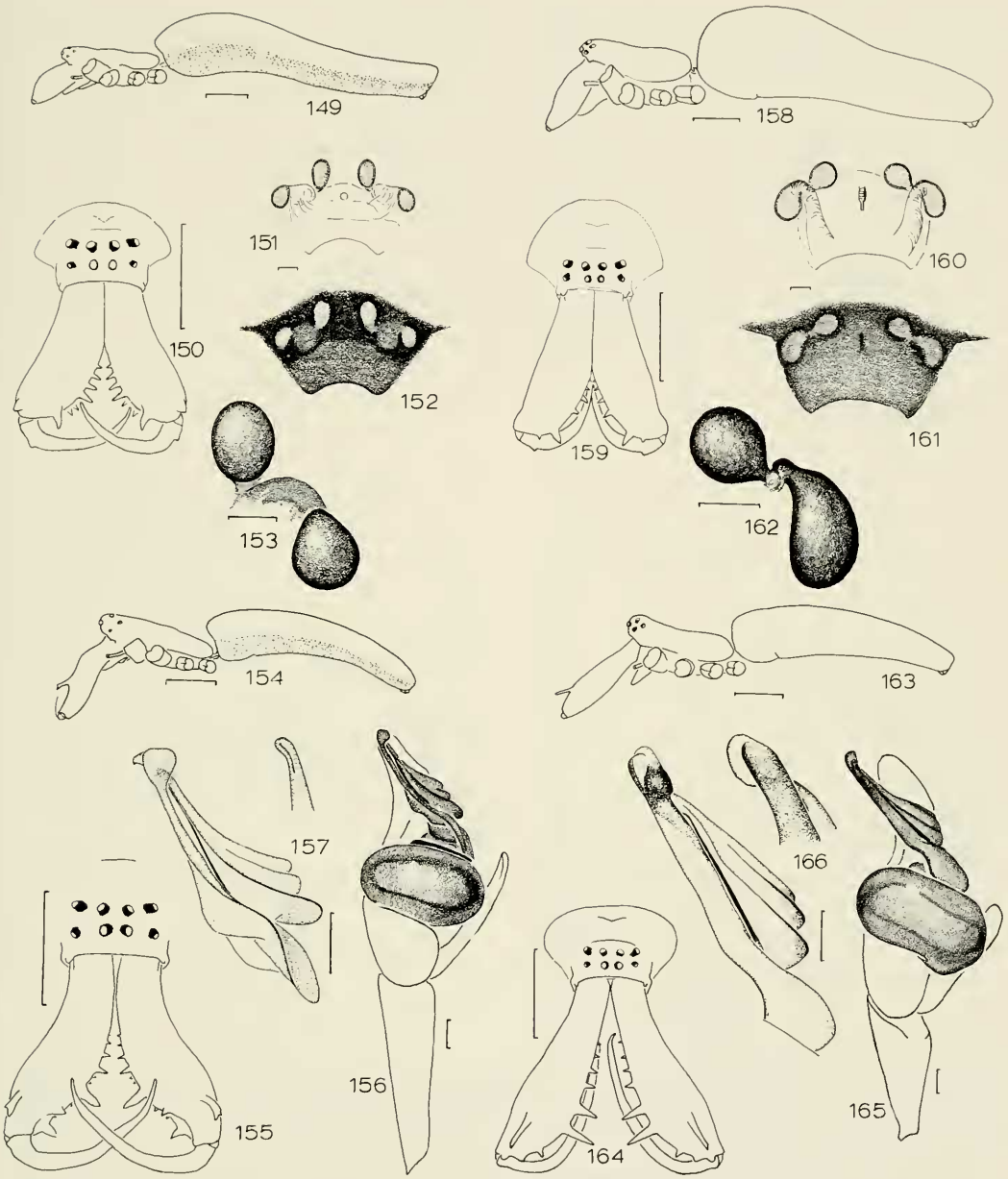
Tetragnatha shoshone new species
Plates 7e, f; Figures 158–166; Map 4

Holotype. Male from Laketown, Rich County, Utah, 30 July 1978 (G. F. Knowlton) in the Museum of Comparative Zoology. The name is a noun in apposition after the Indian tribe.

Description. Female. Carapace, sternum, legs yellowish. Abdomen evenly covered with tiny silver pigment spots all around, except for cardiac area and a narrow ventral band to spinnerets (Fig. 158). Eyes subequal in size, except for anterior laterals, 0.8 diameters of others. Laterals very slightly farther apart than medians (Fig. 159). Total length, 9.4 mm. Carapace, 2.6 mm long, 1.7 mm wide. First femur, 5.2 mm; patella and tibia, 6.0 mm; metatarsus, 5.2 mm; tarsus, 1.4 mm. Second patella and tibia, 3.9 mm; third, 1.9 mm; fourth, 4.0 mm.

Male coloration and eyes like female. Chelicerae as illustrated (Fig. 164). Total length, 6.8 mm. Carapace, 2.5 mm long, 1.4 mm wide. First femur, 5.8 mm; patella and tibia, 7.0 mm; metatarsus, 6.5 mm; tarsus, 1.8 mm. Second patella and tibia, 4.8 mm; third, 2.2 mm; fourth, 4.5 mm.

Variation. Canadian specimens have black pigment on the abdomen: those from Great Slave Lake, two pairs of black



Figures 149–157. *Tetragnatha straminea* Emerton. 149–153. Female. 149. Lateral. 150. Chelicerae and eye region. 151–153. Genital area. 151. Dorsal. 152. Ventral, cleared. 153. Left seminal receptacles, ventral. 154–157. Male. 154. Lateral. 155. Chelicerae and eye region. 156, 157. Left palpus. 156. Ventral. 157. Conductor with embolus, ventral, and tip, mesal.

Figures 158–166. *Tetragnatha shoshone* n. sp. 158–162. Female. 158. Lateral. 159. Chelicerae and eye region. 160–162. Genital area. 160. Dorsal. 161. Ventral, cleared. 162. Left seminal receptacles, ventral. 163–166. Male. 163. Lateral. 164. Chelicerae and eye region. 165, 166. Palpus. 165. Ventral. 166. Conductor with embolus, ventral, and tip, mesal.

Scale lines. 0.1 mm; except Figs. 149, 150, 154, 155, 158, 159, 163, 164, 1.0 mm.

patches; those from Ontario, wavy gray lines on the sides of the dorsum. The lateral eyes are a variable distance apart, always closer than those of *T. pallescens* and *T. straminea*. If close, the lateral eyes are separated about 1.3 times the distance of the medians.

Total length of females, 8.6 to 12.3 mm; total length of males, 5.4 to 8.8 mm. The smallest specimens are those from Utah and Idaho, the largest from the periphery of the range: Ontario and California.

Diagnosis. The lateral eyes are always slightly farther apart than the medians (Figs. 159, 164).

Although *Tetragnatha shoshone* can be confused with *T. extensa*, *T. laboriosa*, *T. pallescens*, and *T. straminea*, males can be separated by the shape of the conductor. *T. shoshone* lacks a mesally-facing beak as conductor tip (Plate 7f), present in *T. laboriosa* and *T. pallescens*. It also lacks the laterally facing, pointed tip of *T. extensa*; it has a wider neck below the conductor tip than does *T. straminea* (Plate 7e, f; Figs. 165, 166).

Females differ from *T. extensa* and *T. laboriosa* in having the lateral eyes slightly farther apart than the medians (Figs. 158, 159). *T. shoshone* can be distinguished from *T. pallescens* by the seminal receptacles: the posterior is larger than and almost touching the anterior (Fig. 162), whereas those of *T. pallescens* are some distance from each other and separated by a lobe of the ducts.

Natural History. This species has been collected sweeping vegetation near large lakes.

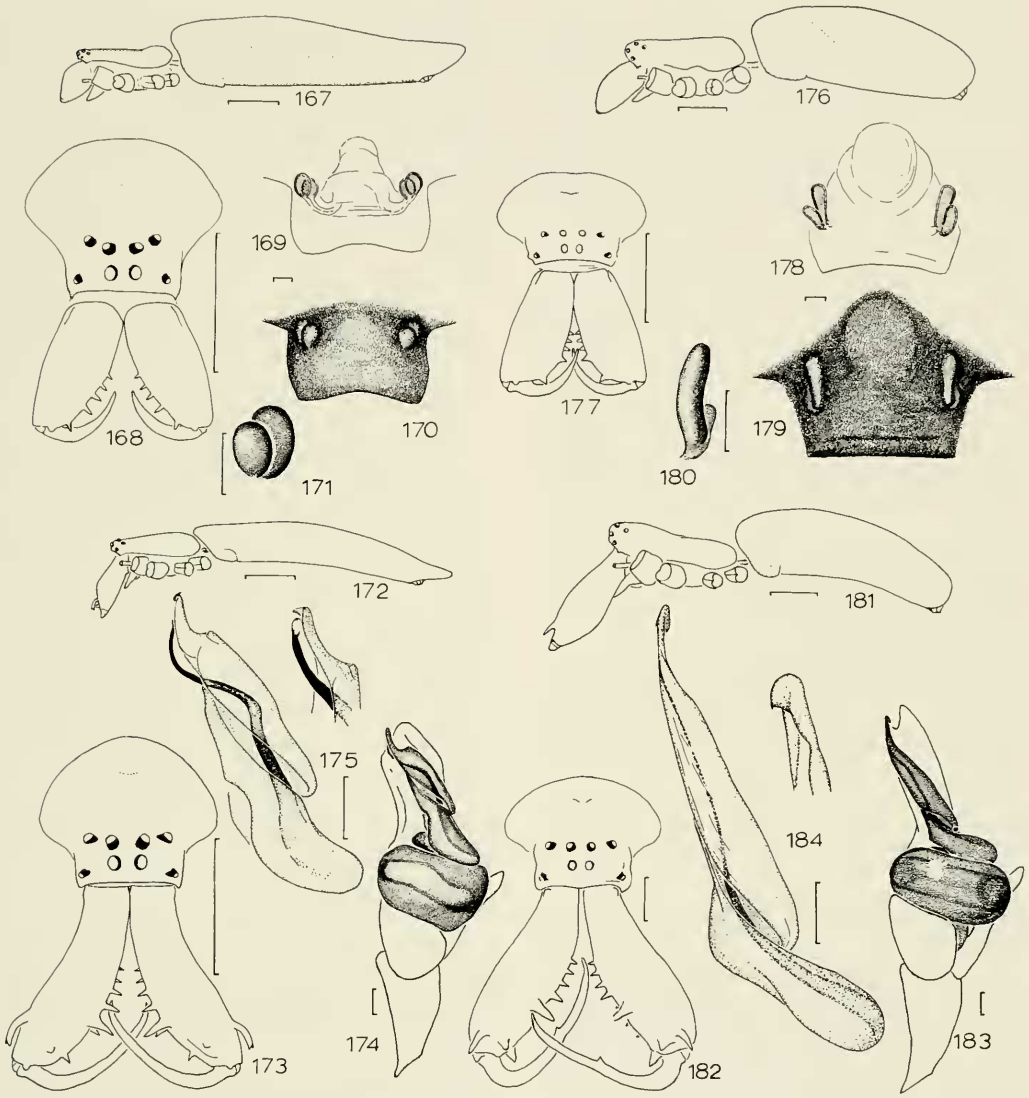
Distribution. From Great Slave Lake, Ontario, Indiana to the Pacific coast (Map 4).

Paratypes. Northwest Territories: 5 mi. S. of Great Slave Lake, 22 July 1944, ♂ (T. Kurata). *Ontario.* Goose Island, Lake Nipissing, 26 July 1931, ♀♀ (T. Kurata). *British Columbia.* Victoria, 1931, ♂. *Indiana.* Steuben Co.: Center Lake, Angola, 23 Aug. 1968, ♀, ♂ (J. Carico). *Illinois.* McHenry Co.: Pistakee Bay, 26 Aug. 1968, ♀, ♂ (J. Carico). *Nebraska.* Scottsbluff Co.: Morrill, on bridge of Glendo Dam overflow, 30 July 1968, ♂ (A. Moreton). *Colorado.* Boulder Co.: Valmont, E. of Boulder, 31 Aug. 1939, ♂ (U. Latham). *Idaho.* Bear Lake Co.: N. shore of Bear Lake, 30 July 1952, ♀♀, ♂♂ (B. Malkin); Mud Lake near Hot Springs, 7 Aug. 1949, ♂♂ (W. J. Gertsch). Twin Falls Co.: Thousand Springs, June 1938, ♀, ♂♂ (W. Ivie). *Utah.* Rich Co.: Laketown, 30 July 1978, ♀♀, ♂ (G. F. Knowlton); Bear Lake, 25 Aug. 1929, ♀, ♂; SE shore Bear Lake, 3 July 1978, ♂ (G. F. Knowlton); Granite, 26 Aug. 1938, ♂ (G. F. Knowlton). Salt Lake Co.: Salt Lake City, 10 July 1947, ♂ (W. Ivie). Sevier Co.: Richfield, July–Aug. 1930, ♂ (W. J. Gertsch). Utah Co.: Utah Lake at mouth of Provo River, 25 June 1941, ♀♀, ♂♂; W. side of Utah Lake, 24 Sept. 1939, ♀♀, ♂♂ (S. Mulaik, W. Ivie). *Washington.* Grant Co.: Dry Falls, Grand Coulee, 4 May 1940, ♀♀, ♂♂ (M. Hatch); 20 June 1954, ♀♀, ♂ (B. Malkin). Pend Oreille Co.: Diamond Lake, 13 Aug. 1934, ♂ (M. Hatch). *California.* Siskiyou Co.: Tule Lake, 15 July 1940, ♀, ♂ (L. W. Saylor).

Tetragnatha branda new species
Plate 7g, h; Figures 167–175; Map 4

Holotype. Male from sweeping salt marsh, Branford Harbor, Connecticut, July 1975 (C. N. Olmstead) in the Museum of Comparative Zoology. The specific name is an arbitrary combination of letters.

Description. Female. Carapace, legs yellow-white. Sternum, labium dusky. There is a median gray longitudinal band on the carapace. Abdomen silvery; sides with some black pigment overlying silver, and venter with a ventral black band. Posterior eyes 0.7 diameters of anterior medians. Anterior laterals 0.5 diameters of anterior medians. Anterior medians are slightly more than their diameter apart, 1.5 from laterals. Posterior median eyes are 3 diameters apart, 2.5 from laterals. The lateral eyes are much farther apart



Figures 167–175. *Tetragnatha branda* n. sp. 167–171. Female. 167. Lateral. 167. Chelicerae and eye region. 169–171. Genital area. 169. Dorsal. 170. Ventral, cleared. 171. Left seminal receptacles, ventral. 172–175. Male. 172. Lateral. 173. Chelicerae and eye region. 174, 175. Left palpus. 174. Ventral. 175. Conductor, embolus, ventral, and tip, mesal.

Figures 176–184. *Tetragnatha vermiformis* Emerton. 176–180. Female. 176. Lateral. 177. Chelicerae and eye region. 178–180. Genital area. 178. Dorsal. 179. Ventral, cleared. 180. Left seminal receptacles, ventral. 181–184. Male. 181. Lateral. 182. Chelicerae and eye region. 183. Palpus, ventral. 184. Conductor with embolus, ventral, and tip, mesal.

Scale lines. 0.1 mm; except Figs. 167, 168, 172, 173, 176, 177, 181, 182, 1.0 mm.

than the medians (Fig. 168). The abdomen is elongate and has a tail overhanging the spinnerets (Fig. 167). Total length, 8.8 mm. Carapace, 2.0 mm long, 1.4 mm wide. First femur, 3.3 mm; patella and tibia, 3.7 mm; metatarsus, 2.7 mm; tarsus, 1.2 mm. Second patella and tibia, 2.7 mm; third, 1.4 mm; fourth, 3.1 mm.

Male. Coloration like female, but with dark pigment. Secondary eyes slightly larger in relation to anterior medians than in female. Anterior median eyes slightly more than their diameter apart, slightly less than two diameters from laterals. Posterior medians slightly more than two diameters apart, the same distance from laterals (Fig. 173). Total length, 6.8 mm. Carapace, 2.2 mm long, 1.3 mm wide. First femur, 3.8 mm; patella and tibia, 4.5 mm; metatarsus, 2.4 mm; tarsus, 1.3 mm. Second patella and tibia, 3.4 mm; third, 1.7 mm; fourth, 3.7 mm.

Variation. Total length of females, 8.8 to 13.8 mm; total length of males, 6.8 to 11.2 mm. All have a relatively short tail.

Diagnosis. The lateral eyes of this species are much farther apart than the medians (Figs. 168, 173). The genitalia (Figs. 169–171) are most like those of *T. vermiformis*, but the species differs by having a tail, the abdomen overhanging the spinnerets.

This species can be confused with *T. caudata*, but the male palpus lacks conductor pleats, and the conductor has a distal, lateral notch (Plate 7g, h; Figs. 174, 175).

The female differs from *T. caudata* by having adjacent, spherical seminal receptacles (Fig. 171).

Natural History. All specimens have been collected from coastal salt marshes.

Distribution. New England to Mississippi (Map 4).

Paratypes. Connecticut. New Haven Co.: Branford Harbor, July 1975, 3♀ (C. N. Olmstead, MCZ). *Georgia.* McIntosh Co.: Sapelo Island, 27 July 1957, ♀ (E. P. Odum, MCZ); July–Aug. 1960, 4♀, 4♂, salt marsh (S. Schmittner, AMNH). *Florida.* Levy Co.: 12 May 1951, ♀, 2♂ (H. K. Wallace, FSCA); Monroe Co.: Cape Sable, 4 June, ♀ (H. V. Weems, FSCA). *Mississippi.* Jackson Co.: Ocean Springs, January 1905, ♀ (J. H. Comstock, CUC).

Tetragnatha vermiformis Emerton
Plate 7i; Figures 176–184; Map 4

Tetragnatha vermiformis Emerton, 1884, Trans. Connecticut Acad. Sci., 6: 333, pl. 39, figs. 12–14, ♀, ♂. One male lectotype and one female paralectotype, plus two female paralectotypes of a different species from Beverly, Massachusetts in the Museum of Comparative Zoology, examined. Seeley, 1928, Bull. New York State Mus., 278: 138, figs. 55–58, ♀, ♂. Roewer, 1942, Katalog der Araneae, 1: 994. Kaston, 1948, Bull. Connecticut Geol. Natur. Hist. Surv., 70: 272, figs. 877–878, ♂. Chickering, 1957, Bull. Mus. Comp. Zool., 116: 349, figs. 103–105, ♂ (not ♀); 1959, Bull. Mus. Comp. Zool., 119: 495, figs. 47–50, ♂ (not ♀).

Eucta vermiformis:—Bonnet, 1956, Bibliographia Araneorum, 2: 1808.

Note. The female specimens illustrated by Chickering had been misidentified.

Variation. Total length of females, 6.7 to 12.3 mm; males, 5.0 to 9.1 mm.

Diagnosis. The lateral eyes are farther apart than the medians, and the abdomen is entirely silver (Figs. 176, 177, 181, 182).

Males can readily be distinguished from the males of the four other species having similar eye placement by the lack of pleats on the long conductor of the palpus. The shape of the conductor tip (Fig. 184) separates *T. vermiformis* from the similar European *T. (Eugnatha) striata*. The absence of a tail distinguishes it from *T. branda* (Plate 7i; Figs. 176, 181, 183, 184).

The female has a much shorter, less worm-shaped abdomen than is seen in the other species with similar eye placement. The abdomen is entirely silver, with fewer spots on the venter. Sometimes there are also black marks on the sides of the abdomen. Unlike *T. caudata*, *T. pallescens*, and *T. straminea*, the seminal receptacles of each pair are narrow

and elongate, placed paraxial, the pair more than twice their length apart and more sclerotized laterally than toward the median (Figs. 178–180).

Natural History. Nothing is known of the habits of this uncommon species. The very similar European *T. striata* is found on reed grass (*Phragmites*) of larger lakes and builds near the open water. It is best collected by using a boat (Wiehle, 1963).

Distribution. Southern Canada, northwest to eastern states to Canal Zone (Map 4).

Records. Ontario. La Seine River, July, ♀ (N. Banks); Lac Seul, Aug. 1919, ♂ (Waugh); Mallorytown Landing, ♀, ♂. *Massachusetts.* Falmouth Co.: Woods Hole, Aug. 1881, ♂ (J. H. Emerton). Nantucket, 9 Sept., ♀, ♂ (J. H. Emerton). *Rhode Island.* Kingston, ♂ (L. G. Worley). *New York,* Long Island: Quogue, Oct. 1948, ♀, ♂ (R. Latham). *Georgia.* Honey Isl. Prairies, Okefenokee Swamp, 31 May 1912, ♀. *Florida.* Alachua Co.: Newnan's Lake, Nov. 1931, ♀, ♂ (T. H. Hubbell). Dade Co.: Tamiami Trail, off Route 27, 19 March 1968 (A. M. Chickering). Lake Co.: Leesburg, March 1954, ♂ (M. Statham). Monroe Co.: Everglades Natl. Park, Shark River area, 1960, ♀. *Michigan.* Walnut Lake, ♂ (A. M. Chickering). Bay Co.: Aug. 1942, ♀ (A. M. Chickering). Calhoun Co.: Albion, July 1930, ♂ (A. M. Chickering). Eaton Co.: Olivet, Sept. 1933, ♂ (A. M. Chickering). Macomb Co.: Selfridge Field, June 1944, ♀, ♂ (B. Malkin). Ogemaw Co.: Aug. 1937, ♂ (A. Peacock). *Indiana.* Steuben Co.: Angola at Center Lake, 25 Aug. 1968, ♂ (J. Carico). *Nebraska.* Holt Co.: Goose Lake, 8 Sept. 1977, ♂ (W. Rapp). *Washington.* Cowlitz Co.: Toutle River, 24 July 1932, ♂ (T. Kincaid).

Panama Canal Zone. Barro Colorado Isl. 6 Feb. 1958, ♀, ♂ (A. M. Chickering).

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